Engineering Library

The Engineer.

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VOL. CXLVIII.—No. 3843] LONDON: FRIDAY EVENING, SEPTEMBER 6, 1929 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

Civil Service Commission.

FORTHCOMING EXAMINATION.

PROBATIONARY INSPECTORS in the Engineering Department of the Post Office (17-23, with extension for service in H.M. Forces).

Regulations and particulars, together with the forms on which applications must be made, will be sent in response to requests (preferably by postcard), addressed to the SECRETARY, Civil Service Commission, Burlington-gardens, London, W. 1. The latest date for the receipt of application forms is 26th September. 2822

Crown Agents for the Colonies.

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/1551.—CHIEF ACCOUNTANT REQUIRED by the GOVERNMENT of PALESTINE for the Haifa Harbour Works, for a tour of three years. Salary P£1000 per annum, rising to P£1150 p.a., by annual increments of P£75. Free quarters or an allowance in lieu and free passages. Candidates under 45 years of age should be Chartered or Incorporated Accountants, must be capable of taking complete charge of accounts, cost-keeping and office work under the Resident Engineer, and must have held similar position on large Public Works Contracts.

M/1569.—ASSISTANT DISTRICT ENGINEER REQUIRED by the GOVERNMENT of CEYLON for the Railway Department for three years' service with possible extension. Salary £450, rising to £600 a year by annual increments of £30. Candidates, preferably unmarried, between the ages of 26 and 31, should have passed sections "A" and "B" of the examinations for the A.M.I.C.E. diploma, or hold professional qualifications recognised by the Institution of Civil Engineers as exempting from those examinations. Should have had at least three years' suitable experience on Railway Construction or on Maintenance work. Must be capable of assisting a District Engineer in charge of a District of about 200 miles, carrying on any or all the duties of the District Engineer if and as required.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 3100

Ministry of Health.

ENGINEERING INSPECTOR.

APPLICATIONS are INVITED by the Minister of Health for APPOINTMENT as ENGINEERING INSPECTOR.

The salary commences at £600 per annum and rises by yearly increments of £25 to a maximum of £1000. In addition to the salary a bonus, which varies with the cost of living, is payable. The bonus on the minimum salary is at present £176 7s.

The appointment will carry the usual Civil Service conditions as to pension, holidays, &c.

Candidates must be Chartered Civil Engineers having had wide experience in the designing and carrying out of works, especially works of sewerage and sewage disposal. Special consideration will be given to candidates with an Honours Degree in Engineering.

Preference will be given to candidates who served in His Majesty's Forces during the war.

No candidate can be considered unless he is over thirty years of age on the 1st September, 1929.

Successful candidates will be required to devote their whole time to the public service and must be prepared to take up their duties without undue delay. The Headquarters of the Engineering Inspectors are in London.

Canvassing Members of Parliament or Officers of the Ministry will render a candidate liable to disqualification.

Forms of application, with further particulars of the appointment, may be obtained from

THE DIRECTOR OF ESTABLISHMENTS,
Ministry of Health,
Whitehall, S.W. 1.

No application will be considered unless received on the prescribed form not later than the 28th September, 1929. 3034

Ministry of Transport.

ROADS DEPARTMENT.

APPLICATIONS are INVITED for a POST of JUNIOR UNESTABLISHED ASSISTANT ENGINEER in London, to assist with the Examination of Bridge Schemes.

Candidates should have completed a recognised course of theoretical and practical engineering and should possess an Engineering Degree. Practical experience in the design and construction of bridges would be an advantage.

The salary ranges between £250 and £350 inclusive.

Applications for forms should be made to the ESTABLISHMENT OFFICER, Ministry of Transport, 6, Whitehall-gardens, S.W. 1. Last day for receipt of applications 18th September. 3091

The Government of India

invite APPLICATIONS for FIVE APPOINTMENTS of ASSISTANT ENGINEER (INSPECTION) in the Indian Stores Department, three for Structural and Bridge Inspection Work and two for Mechanical Engineering Inspection Work.

QUALIFICATIONS AND CONDITIONS.

A.—STRUCTURAL AND BRIDGE.—A full apprenticeship in structural engineering workshops and drawing-office experience. Special experience of structural steel and bridge work. Desirable candidates should have passed examination for Associate Membership of Institution of Civil Engineers or of Institution of Mechanical Engineers or of Institution of Engineers (India), or possess engineering degree qualifying for exemption.

Pay Rs. 500, rising by annual increments of Rs. 50 to Rs. 750 a calendar month, with a personal allowance of Rs. 200 a month and certain other allowances. Commencing rate of pay within this scale depends on age and qualifications.

B.—MECHANICAL ENGINEERING.—A full apprenticeship in mechanical engineering workshops and drawing-office experience. Experience as working mechanic in shops. Candidates should have passed Associate Membership Examination, Institution of Civil Engineers or Institution of Mechanical Engineers or Institution of Engineers (India), or possess engineering degree qualifying for exemption.

Pay Rs. 500, rising by annual increments of Rs. 50 to Rs. 750 a calendar month and certain other allowances.

A and B, age 24 to 35 years.

Free first-class passages to and from India. Provident Fund.

Further particulars and forms of application may be obtained upon request by postcard, stating which appointment desired, from the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for the receipt of applications 7th October, 1929. 3032

The Engineer

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SHIPPING, ENGINEERING & MACHINERY EXHIBITION, OLYMPIA, SEPTEMBER 12th-28th.

"THE ENGINEER'S" STAND will be No. 9, ROW D, at which all our friends will be Welcome.

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PUBLIC NOTICES

Junior Engineering

ASSISTANT REQUIRED for Crown Agents' Drawing-office. Candidates must possess sound practical and theoretical knowledge of Railway Carriage and Wagon Practice and should have received training in railway workshops or with a good firm of rolling stock manufacturers.

Commencing salary £100-£150 per annum plus Civil Service cost-of-living bonus at rates current from time to time, according to the ability of the candidate selected, rising to £250 per annum plus bonus by annual increments of £15. The bonuses at present payable are approximately as follows :—On £100, £66 ; on £150, £82 ; and on £250, £111.

Applicants should state their age and give full particulars of their education, technical qualifications and practical experience, and should give the names of at least two responsible persons to whom references can be made regarding their technical attainments and personal character.

Applications should be addressed to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting reference O/Sec. Office/154. 3062

Borough Polytechnic Institute,

BOROUGH-ROAD, LONDON, S.E. 1.

ENGINEERING DEPARTMENT.

COMPLETE COURSES extending over five years of evening work, leading to the Ordinary and Higher National Certificates.

Engineering Science.
Properties and Strength of Materials.
Heat Engines.
Theory of Machines and Machine Design.
Structural Engineering Drawing.
Structural Steel Work Design.
Reinforced Concrete Design.
Heating and Ventilation.
Refrigeration.
Motor Car Engineering and Design.
Engineers' Quantities and Estimates.
Engineering Economics.
Practical Mathematics.

Enrolment, 16th, 18th and 20th September, 7 to 9 p.m.

Prospectus will be forwarded on application.

J. W. BISPHAM,
Principal.

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PUBLIC NOTICES

UNIVERSITY OF LONDON.

King's College.

FACULTY OF ENGINEERING.

COMPLETE COURSES of STUDY are provided in CIVIL, MECHANICAL and ELECTRICAL ENGINEERING for the Engineering Degrees of the University of London and for the Diplomas and Certificate of the College.

POST-GRADUATE COURSES in CIVIL, MECHANICAL, ELECTRICAL and CHEMICAL ENGINEERING are also provided.

HEADS OF DEPARTMENTS :

Professor E. WILSON, M. Inst. C.E., M.I.E.E., Wh.Sch., Electrical Engineering (Dean).
Professor G. COOK, D.Sc., M.I. Mech. E., A.M. Inst. C.E., Mechanical Engineering.
S. J. DAVIES, M.Sc., M.I. Mech. E., Reader in Mechanical Engineering.
Professor A. H. JAMESON, M.Sc., M. Inst. C.E., Civil Engineering.
C. H. LOBBAN, D.Sc., A.M. Inst. C.E., Reader in Civil Engineering.
F. S. ROBERTSON, M.I.E.E., Senior Lecturer in Electrical Engineering.
Professor S. A. F. WHITE, M.A. } Mathematics.
Professor A. E. JOLLIFFE, M.A. }

Considerable extensions have been made in the Engineering Department. These include a large additional drawing-office, lecture room and laboratory for Hydraulics and Strength of Materials in the Civil and Mechanical Departments, and research rooms, including Wireless Telegraphy, in the Electrical Engineering Department. Large additions have been made to the equipment of the Laboratories in the three Departments for purposes of teaching and research.

There is a College Hostel and a large Athletic Ground.

For full information apply to the SECRETARY King's College, Strand, W.C. 2. 2723

PUBLIC NOTICES

City of Cardiff Education Committee.

THE TECHNICAL COLLEGE.

PRINCIPAL - CHARLES COLES, B.Sc. (Lond.).

DEPARTMENT OF ENGINEERING.

HEAD OF DEPARTMENT : A. W. LOVERIDGE, B.Sc. (Eng.), A.R.C.Sc.

SESSION 1929-30.

(Commencing on Monday, 30th September, 1929.)

The following COURSES have been arranged for Engineering students :—

A THREE YEARS' COURSE in MECHANICAL and MARINE ENGINEERING, jointly with the University College of South Wales and Monmouthshire.

A TWO YEARS' COURSE for Apprentices and others, with facilities for practical experience in the Summer Term.

These Courses are suitable for students preparing for Degrees in Engineering or for the Examinations of the Engineering Societies.

Special Courses are also arranged for Marine Engineers preparing for the Examinations of the Board of Trade.

OPEN SCHOLARSHIPS, covering tuition fees and maintenance grants of £40 per annum for three years, are offered for competition annually, and candidates for entry to the above Department are eligible to compete.

For further particulars of Full-time and Part-time Courses, Entrance Examination, Scholarships, Fees, &c., apply to the Principal. Application forms for entrance scholarship examination, duly filled up, must be received before September 14th.

THOMAS McHOWAT, Director of Education, City Hall, Cardiff. 2982

ADMINISTRATIVE COUNTY OF LONDON.

L.C.C. School of Engineering and Navigation,

HIGH STREET, POPLAR, E.14.

Principal :
J. PALEY YORKE, M.Sc., A.M.I.E.E.

Secretary : F. N. BUTCHER.

MECHANICAL ENGINEERING DEPARTMENT.

Major courses in mechanical, marine and civil engineering, and minor courses in mechanical engineering will commence on

MONDAY, 23RD SEPTEMBER, 1929.

ENROLMENT during week commencing 16th September.

The major courses are "recognised" for the National Certificates in mechanical engineering, both senior and advanced.

Courses are provided for the examinations for A.M.I. Mech. E. and A.M.I.C.E., and for those wishing to join the Royal Navy and Royal Air Force.

Prospectus and Full particulars can be obtained from the Secretary at the School.

MONTAGU H. COX.
Clerk of the London County Council.
3036

NORTHERN INDIA

ENGINEERING DEVELOPMENT.

Many huge projects are completed, others are under construction, and still more are under consideration. When tendering, remember that we have handled, inter alia, all the material for the Lloyd Barrage, the largest irrigation scheme in the world, and that WE HAVE THE EXPERIENCE to enable us to quote you the most favourable terms for CLEARING and DESPATCHING up country any quantity of material to any site required.

For full particulars apply, EASTERN EXPRESS CO., Ltd., Karachi ; or to Messrs. FORBES, FORBES, CAMPBELL and CO., Ltd. (Managing Agents), 9, King William-street, London, E.C. 4. P 8899

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PUBLIC NOTICES

Northampton Polytechnic INSTITUTE,

St. John-street, London, E.C. 1.

SCHOLARSHIPS IN ENGINEERING AND OPTICS.

An examination will be held on September 17th and 18th at the Polytechnic for the award of the following SCHOLARSHIPS :—

THREE SCHOLARSHIPS in ENGINEERING, value £18 per annum.

These scholarships are tenable at courses extending over four years in Civil, Mechanical Electrical or Aeronautical Engineering, and including ten months' practical experience in the Works of large industrial firms.

ONE SCHOLARSHIP in OPHTHALMIC OPTICS, value £18 per annum.

ONE "AITCHISON MEMORIAL" SCHOLARSHIP in OPHTHALMIC OPTICS, value £18 per annum.

For further information apply to :—

S. C. LAWS, M.A., M.Sc., Principal.

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Northampton Polytechnic INSTITUTE,

St. John-street, London, E.C. 1.

EVENING CLASSES IN

ENGINEERING.
All branches of Civil, Mechanical, Electrical, Aeronautical, Automobile and Radio Engineering.
APPLIED OPTICS.
Ophthalmic Optics, Optical Instrument Making, Optical Glass Working.
HOROLOGY.
FURRIERY.
APPLIED CHEMISTRY.
Fuels, Electro-plating, Metallurgy, &c.
DOMESTIC AND ALLIED SUBJECTS.
Commence SEPTEMBER 23rd.
ENROLMENTS during week commencing SEPTEMBER 16th.

Free prospectus on application to :—

S. C. LAWS, M.A., M.Sc., Principal.

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Northampton Polytechnic INSTITUTE,

CLERKENWELL, E.C. 1.

EVENING COURSES IN FUEL TECHNOLOGY AND METALLURGY.

FUEL TECHNOLOGY COURSES for Combustion and Power-house Engineers comprise :—

LECTURES on the Chemistry of Combustion and the Thermal Efficiencies of Furnaces.

LABORATORY WORK dealing with Calorimetry Fuel and Gas Analysis, the Examination of Feed Water and Allied Subjects.

METALLURGY COURSES for Engineers deal with the Extraction, Physical Properties, Commercial Application and Heat Treatment of Ferrous and Non-ferrous Metals, while the Laboratory Work includes the Microscopic Examination of these Products.

Session commences September 23rd, 1929. Enrolments, September 16th.

Free particulars on application. 3038

The Royal Technical College, GLASGOW.

DEPARTMENTS OF ENGINEERING.

MECHANICS AND MECHANICAL ENGINEERING : Professor Alexander L. Mellanby, D.Sc., M.I. Mech. E.
Associate Professor William Kerr, Ph.D., A.R.T.C., M.I. Mech. E.

ELECTRICAL ENGINEERING : Professor Stanley Parker Smith, D.Sc., M.I.E.E., A.M. Inst. C.E.

CIVIL ENGINEERING : Professor George Moncur, B.Sc., M. Inst. C.E., M. Amer. Soc. C.E.

MINING ENGINEERING : Professor Daniel Burns, M. Inst. M.E.

CHEMICAL ENGINEERING : Professor of Technical Chemistry : Thomas Gray, D.Sc., LL.D., Ph.D., F.I.C.

Complete courses of instruction are provided, qualifying for the Diploma and Associateship of the College and for the Degree of B.Sc. in Engineering of Glasgow University.

Composition fee, 25 guineas per annum.

SESSION 1929-30 BEGINS on TUESDAY, SEPTEMBER 24th.

Calendar, by post, 3s., and prospectus, gratis, may be obtained on application to the SECRETARY. 2491

CITY OF LONDON.

The Sir John Cass Technical INSTITUTE,

JEWRY STREET, ALDGATE, E.C. 3.

Principal :
GEO. PATCHIN, A.R.S.M., M. Inst. M.M.

METALLURGY for ENGINEERS;
ALSO
EVENING UNIVERSITY COURSES.

The following COURSES MEET the REQUIREMENTS of ENGINEERS and those wishing to prepare for the degree of B.Sc. (Eng.) in Metallurgy of London University :—

GENERAL METALLURGY.
ELECTRO-METALLURGY.
METALLURGICAL ANALYSIS AND ASSAYING.
FUEL AND REFRACTORIES.
METALLOGRAPHY, PYROMETRY AND HEAT TREATMENT.
MECHANICAL TESTING OF METALS AND ALLOYS.
ECONOMIC GEOLOGY.

NEW SESSION COMMENCES SEPTEMBER 23RD, 1929.

ENROLMENT on and after September 16th, 5.30-8.30 p.m.

For details of the courses apply at the Office of the Institute, or by letter to the PRINCIPAL. 3039

County Borough of Croydon.

EDUCATION COMMITTEE.

TEACHERS are REQUIRED in the following subjects, for evening instruction (7.30-9.30), in the Mechanical Engineering Department of the Croydon Polytechnic, for Winter Session opening 23rd September, 1929 :—

1st Year Science Laboratory, Thursdays (Assistant Chemistry and Physics).
2nd Year Science Laboratory, Wednesdays (Assistant, Mechanics).
3rd Year Science Laboratory, Wednesdays (Mechanics and Heat).
4th Year Engineering Calculations, Wednesdays.
1st Year Machine Drawing, Fridays.

The fee varies from 12s. 6d. per evening of 2 hours for the lowest appointments to 18s. per evening of 2 hours for the highest, according to qualifications.

State fully, particulars of education, practical training, experience, present appointments, and age to the Principal, Central Polytechnic, Scarbrook-road, Croydon.

R. B. MORGAN, Education Officer.

Education Office, Katharine-street. 2915

YARROW HOME and HOSPITAL FOR CHILDREN BROADSTAIRS.

For the Early & Preventive Treatment of Disease & Convalescence after illness.

In these days of high cost of living, people of limited means are sometimes placed in a difficulty when their children are ill or need operations and afterwards require a change of air and much careful attention during convalescence. It cannot be too well known that the Yarrow Home and Hospital for Children, Broadstairs, Kent, was founded specially for the children of those who are not too well endowed with this world's goods. At this Home a child recovering from illness or an operation, or needing a long course of medical or surgical treatment, receives, amid the happiest possible surroundings and companionship, careful nursing and attention, such as could ordinarily only be obtained at expensive nursing homes. There are beds for fifty boys between the ages of four and twelve years, and for fifty girls between the ages of four and fourteen years. In special cases these age limits may be exceeded by two years. The fee is one guinea per week and travelling expenses. Applications for the entrance of patients are welcomed from professional people, such as members of the Institution of Civil Engineers, architects, artists, authors, clergymen, members of the medical, legal, and other professions, members of scientific societies, officers of the Navy, Army, and Royal Air Force, officers of the merchant navy, school masters, university professors, &c. The Loudon office is at 116, Victoria-street, Westminster, and the Secretary will be pleased to send full particulars to anyone who is interested.

PUBLIC NOTICES

The University of Sheffield.

SESSION 1929-30.

Vice-Chancellor : SIR HENRY HADOW, C.B.E., D.Mus., LL.D.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

RESEARCH Fellowships and Scholarships are awarded annually.

The LECTURE COURSES commence OCTOBER 2nd, 1929.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 24th, 1929.

Particulars of Entrance and Research Scholarships available will be sent on application.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS, Registrar.

2923

Witwatersrand Technical INSTITUTE.

APPLICATIONS are INVITED for the following POST :—

LECTURER IN ENGINEERING.

Salary scale £350-25-£450 plus local allowance. Local allowances : Married officer, £59 to £66 ; single officer, half these amounts.

The initial salary may be fixed according to existing salary, qualifications and experience of the successful applicant, who will be required to join the Provident Fund. The appointment is full time and includes both day and evening work.

Candidates must have had workshop training, and the possession of a degree or equivalent qualification and teaching experience will be a recommendation.

Applications in duplicate, giving full particulars of training and experience, must be submitted to CHALMERS and GUTHRIE (MERCHANTS), Ltd., 9, Idol-lane, London, E.C. 3, on or before 30th September, 1929, from whom conditions of service and special application forms may be obtained. 3040

River Wear Commissioners.

NO. 23 COAL STAITH SUPERSTRUCTURE.

The River Wear Commissioners are prepared to receive TENDERS for the MANUFACTURE and ERECTION of ONE or BOTH of the following :—

(a) A STEEL and TIMBER COAL LOADING STAITH, LAYING thereon of LINES of RAILWAY and the EXECUTION of other WORKS in connection therewith ;

(b) COAL HOPPERS, SHOOTS and an ELECTRICALLY DRIVEN COAL BELT CONVEYOR in the above Staith, upon land adjoining the Hudson Dock South, Sunderland.

The conditions of contract, forms of Tender, specification, schedules of quantities and drawings may be seen at the offices of the Commissioners upon application to the undersigned before the 14th day of September, 1929, or may be obtained until that date on payment of the sum of Ten Pounds (£10) by crossed cheque, which will be returned on receipt of a bona fide Tender accompanied by the whole of the documents.

Tenders, which will only be accepted on the forms supplied, must be completed in accordance with the detailed instructions incorporated in the documents, enclosed in a cover, sealed and endorsed "Tender for No. 23 Coal Staith Superstructure," and delivered to the undersigned at the Commissioners' Offices, Sunderland, not later than 10 a.m. on the 30th day of September, 1929.

The River Wear Commissioners reserve the right to reject a Tender without assigning a reason, and do not bind themselves to accept the lowest or any Tender.

F. HUMBLE, Clerk to the Commissioners.

Harbour and Dock Offices, St. Thomas-street, Sunderland, 30th August, 1929. 2997

South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

MADRAS IMPROVEMENTS — ELECTRIFICATION OF SUBURBAN SERVICES.
OVERHEAD CONTACT AND DISTRIBUTION LINES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked :—"Tender for Overhead Contact and Distribution Lines," with the name of the firm Tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 11th October, 1929.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of the specification.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD, Managing Director.

91, Petty France, Westminster, S.W. 1. 4th September, 1929. 3099

PUBLIC NOTICES

Bombay Port Trust.

The Trustees of the Port of Bombay have FOR DISPOSAL the SELF-PROPELLING STEAM HOPPER BARGE "PEEWIT," with a carrying capacity of 600 tons.

The vessel was built for the Bombay Port Trust in 1910 by Messrs. Wm. Simons and Co., Ltd., Renfrew, Scotland. It is now in Bombay Harbour and is surplus to the requirements of the port.

Some particulars of the vessel are as follows :—

Length between perpendiculars, 168ft.; breadth moulded, 28ft.; depth moulded, 13ft. 6in.; draught light forward, 4ft. 11in.; aft, 9ft. 4in.; draught loaded forward, 9ft. 5in.; aft, 11ft. 4in.; gross tonnage, 536.73. Two sets compound surface condensing engines, twin screws. Designed speed 10 knots.

For further particulars apply to the CONSULTING ENGINEERS and AGENTS, Bombay Port Trust, 2, Queen Anne's-gate, Westminster, S.W. 1 ; and for an opportunity to inspect the vessel apply to the CHIEF ENGINEER, Bombay Port Trust, Ballard-road, Fort, Bombay. 3033

Borough of Richmond (Surrey).

WATERWORKS DEPARTMENT.

TENDER FOR THE SUPPLY OF CAST IRON STRAIGHT PIPES AND SPECIALS.

The Corporation invite TENDERS from Manufacturers for the SUPPLY of the following CAST IRON PIPES and SPECIALS :—

150 Tons of 12in. dia. Socket and Spigot Pipes, 12ft. long.
300 Tons of 9in. dia. Socket and Spigot Pipes, 12ft. long.
18 Tons of 6in. dia. Socket and Spigot Pipes, 12ft. long.
20 Tons of 14in. to 3in. dia. Socket Irregulars.
2 Tons of 14in. to 3in. dia. Flanged Irregulars.

Specification and form of Tender may be obtained from Mr. H. P. Williamson, M.C., M. Inst. C.E., Water Engineer and Manager, Hotham House, Heron Court, Richmond, Surrey, on a deposit of a crossed cheque for £3 3s., which will be returned on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for Cast Iron Pipes," should be delivered to the undersigned not later than 10 a.m. on Monday, the 23rd September, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

EDWIN M. NEAVE, Town Clerk.

Town Hall, Richmond, Surrey, September, 1929. 3081

Borough of Richmond (Surrey).

WATERWORKS DEPARTMENT.

TENDER FOR LAYING AND JOINTING 12IN., 9IN., AND 6IN. DIA. CAST IRON PIPES.

The Corporation invite TENDERS from experienced Contractors for the LAYING and JOINTING of the following CAST IRON PIPES :—

About 1450 Lineal Yards of 12in. dia. Pipes.
About 4460 Lineal Yards of 9in. dia. Pipes.
About 450 Lineal Yards of 6in. dia. Pipes.

Specification, bill of quantities, and form of Tender may be obtained from Mr. H. P. Williamson, M.C., M. Inst. C.E., Water Engineer and Manager, Hotham House, Heron Court, Richmond, Surrey, on deposit of a crossed cheque for £3 3s., which will be returned on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for Pipe Laying," should be delivered to the undersigned not later than 10 a.m. on Monday, the 23rd September, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

EDWIN M. NEAVE, Town Clerk.

Town Hall, Richmond, Surrey, September, 1929. 3082

Borough of Richmond (Surrey).

WATERWORKS DEPARTMENT.

TENDER FOR THE SUPPLY OF SLUICE VALVES AND FIRE HYDRANTS.

The Corporation invite TENDERS from Manufacturers for the SUPPLY of SLUICE VALVES and FIRE HYDRANTS.

Specification and form of Tender may be obtained from Mr. H. P. Williamson, M.C., M. Inst. C.E., Water Engineer and Manager, Hotham House, Heron Court, Richmond, Surrey, on deposit of a crossed cheque for £3 3s., which will be returned on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for Valves and Hydrants," should be delivered to the undersigned not later than 10 a.m. on Monday, the 23rd September, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

EDWIN M. NEAVE, Town Clerk.

Town Hall, Richmond, Surrey, September, 1929. 3083

Richmond Main Sewerage BOARD

The Board are prepared to receive TENDERS on behalf of the Joint Committee of the Middlesex and Surrey County Councils (Middlesex and Surrey Thames Bridges Act, 1925) for

DIVERSION OF A CERTAIN LENGTH OF THE BOARD'S MAIN SEWER IN THE PARISH OF MORTLAKE.

Specifications and drawings may be inspected at the Office of Mr. William Fairley, M. Inst. C.E., Parliament Mansions, Westminster, S.W. 1, or at the Main Drainage Works, West Hall-road, Kew Gardens, Surrey.

Copies of the quantities may be obtained on a deposit of a crossed cheque for £3 3s., made payable to the Board, which deposit will be returned on receipt of a bona fide Tender.

Sealed Tenders on forms provided must be received by the undersigned on or before 12 o'clock Noon 30th September, 1929.

Security for the due fulfilment of the contract will be required in accordance with Statute.

The lowest or any Tender may not be accepted.

WILLIAM MERRICK, Clerk to the Board.

Bank Chambers, 39, George-street, Richmond, Surrey. 2955

PUBLIC NOTICES

County Borough of Wolverhampton.

WATER UNDERTAKING.

JUNIOR ENGINEERING ASSISTANT.

APPLICATIONS are INVITED for the POST of JUNIOR ENGINEERING ASSISTANT at a salary of £210 per annum, rising by annual increments of £10 to £270 per annum, in accordance with the Corporation's Salary Grading Scheme, and subject to percentage deductions in accordance with the Local Government and Other Officers Superannuation Act, 1922. The selected candidate will be required to pass a medical examination.

Applications, stating age, qualifications and experience, together with copies of three testimonials, must be delivered to the undersigned on or before the 18th of September, 1929.

Envelopes are to be endorsed "Junior Engineering Assistant."

J. BROCK ALLON, Town Clerk.

Town Hall, Wolverhampton, 1st September, 1929. 3057

Sudan Government.

The Sudan Government REQUIRE a young MECHANICAL ENGINEER as Assistant to the Water Supply Engineer (Pumping Schemes) in the Public Works Department. Age not less than 23 years. Applicants must have had a good general education, preferably at a public school ; must possess a University Degree ; and should during their pupilage or subsequently have undergone a course in water engineering and in the use of well drilling plant. If during the first two years' probationary period the selected candidate performs satisfactory service he will become eligible for permanent and pensionable employment with progressive increases of salary up to £E936 per annum. Commencing salary £E480 to £E540 per annum, according to age and qualifications ; £E1 equals £1 0s. 6d. Strict medical examination. Free second-class passage.

Apply by letter to the ADVISORY ENGINEER, Sudan Government London Office, Wellington House, Buckingham-gate, London, S.W. 1, marking the envelope "Engineer." 3094

Surrey County Council.

HIGHWAYS AND BRIDGES DEPARTMENT.

APPLICATIONS are INVITED for the following APPOINTMENTS :—

ASSISTANT ENGINEERS (3), at salaries at the rate of from £5 to £10 per week, according to qualifications and experience.

JUNIOR ENGINEERING ASSISTANTS (4), at a salary at the rate of £3 10s. per week.

Applicants must have had experience in the Preparation of Plans, Specifications, and Quantities, and in Setting Out and Supervising the Execution of Road Works.

Preference will be given to candidates who are Associate Members of the Institution of Civil Engineers, and/or possess the Testamur of the Municipal and County Engineers.

The appointments will be to the Temporary Staff, and will not be subject to the Local Government Officers' Superannuation Act, 1922.

Applications, in candidates' own handwriting, stating age, experience, and qualifications, together with copies of recent testimonials, to be addressed to and must reach the County Engineer, Milner-road Annexe, Kingston-on-Thames, not later than Saturday, the 14th September, 1929.

DUDLEY AUKLAND, Clerk of the County Council.

County Hall, Kingston-on-Thames. 27th August, 1929. 3010

Wolverhampton Corporation

WATER UNDERTAKING.

JUNIOR ENGINEERING ASSISTANT.

APPLICATIONS are INVITED for the POST of JUNIOR ENGINEERING ASSISTANT at a salary of £210 per annum, rising by annual increments of £10 to £270 per annum, in accordance with the Corporation's Salary Grading Scheme, and subject to percentage deductions in accordance with the Local Government and other Officers' Superannuation Act, 1922. The selected candidate will be required to pass a medical examination.

Applications, stating age, qualifications and experience, together with copies of three testimonials, must be delivered to the undersigned on or before the 23rd of September, 1929.

Envelopes are to be endorsed "Junior Engineering Assistant."

B. L. McMILLAN, Water Engineer and Manager.

Town Hall, Wolverhampton. 30th August, 1929. 3057

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ENGINEER, with Good Knowledge of Hydraulic Machinery and General Machine Shop Practice, for the commercial side of business. London district.—Address, stating age, experience, and salary expected, P6135, The Engineer Office. P6135 A

WANTED, Experienced MAN for Publicity Department in Engineering Works, South of England. Must have up-to-date methods and thoroughly acquainted with publicity work.—Address, 3096, The Engineer Office. 3096 A

ALLOYED TOOL STEELS.—Well-known Manufacturers REQUIRE two efficient SALESMEN for Midlands and London, with first-class Sheffield experience and sound metallurgical knowledge. Responsible POSTS for suitable men.—Address, P6163, The Engineer Office. P6163 A

COMMERCIAL MANAGER.—WELLINGTON TUBE WORKS DESIRE to APPOINT a FIRST-CLASS MAN, well educated and good personality, to Assist in Organising and Management of Sales. Excellent opportunity is presented and full particulars of experience, present position, age, &c., will be required. Applications, which will be treated in confidence, will be received and considered up till September 12th, and should be addressed to the MANAGING DIRECTOR, Wellington Tube Works, Ltd., Great Bridge, Staffordshire. P6134 A

DIESEL ENGINEER of Good Social Standing, with practical and commercial experience, and capable of Supervising Erection and Running of Oil Engines, is WANTED for INDIA.—State full particulars as to experience and salary required, &c., to ATLAS DIESEL CO., Ltd., New Oxford House, Hart-street, London, W.C. 1. 2981 A

ELECTRICAL ENGINEERS—Well-known Firm—REQUIRE MAN to Take Charge of Planning Dept. Extensive works experience essential, also fullest knowledge of latest Quantity Production Methods. Previous references extremely important.—Address, 3045, The Engineer Office. 3045 A

ELECTRICAL ENGINEER REQUIRED for Executive and Inspecting POST in NITRATE FIELDS in Chile. Would have complete charge electrical equipment, fourteen factories. Must be highly qualified and recommended. Knowledge of Spanish preferable but not essential. Salary about £1000 per annum, all found.—address, stating particulars, to 3097, The Engineer Office. 3097 A

EXPERIENCED ENGINEER REQUIRED By large General Engineering Firm (London District) to assist Chief Inspector. Must have had a wide experience on the inspection of high-class interchangeable parts to close limits and to pass Government inspectors, both during production and after assembly. Must also have been employed in a similar capacity.—Address, stating age, salary required and details of experience, in chronological order, to 2971, The Engineer Office. 2971 A

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

Volk's Electric Railway.

OWING to improvements that are projected on the Brighton front, Volk's electric railway, opened in 1883, is threatened with extinction at the end of the present month. Proposals to abolish this interesting example of early electric transport have been made in the past, but up to the present the railway has managed to survive. As we explained in a Supplement on Electric Transport, published in November of 1911 it was the first electric line to be put into operation in England, and originally it was only a quarter of a mile long. During the first five months of its existence, it carried 30,000 passengers. Last year it carried no fewer than 1,107,000 passengers. From the time of its inception, it has proved a success. Originally, it was worked from a gas-driven plant, but for a long time past it has been supplied from the Brighton Corporation's mains, through a motor generator set. The well-known Portrush and Bushmills electric railway in Ireland, now known as the Giant's Causeway and Portrush Electric Tramway, was opened a little earlier in 1883 than Volk's railway, and it was the first electric railway in the United Kingdom. The first electric railway in the world with current supplied to the motor from an insulated rail was unquestionably that shown at an exhibition held in Berlin in 1879 by Wierner von Siemens, although as far back as 1842 a Mr. R. Davidson ran a primary battery locomotive on the Edinburgh and Glasgow Railway.

The River Severn.

AT the annual meeting of the Severn Commission, held at Worcester a few days ago, a plan was outlined to encourage manufacturers and traders to use the river Severn. It was stated that a committee had been formed with a view to establishing a "River Severn Development Association," representative of local bodies and transport, power, and trading organisations, with the object of setting up a central organisation for obtaining information connected with the river and to carry out an advertising campaign setting forth the advantages of the watershed as an industrial area. It is hoped that the efforts of the organisation will result in an increase of traffic on the river. The chairman explained that there had been a very substantial additional revenue from the conveyance of petrol and its storage on the river. The general tolls on the other principal traffic had not, however, been maintained. Owing to the change in the habit of trading, as far as milling is concerned, the grain traffic has declined, and it is feared that it will continue to decline. Whilst at one time there were some fifty or sixty mills receiving grain through the waterways, there are now only five or six. It is expected, however, that there will be some increase in revenue during the coming autumn from the use of water from the river by the Shropshire, Worcestershire and Staffordshire Electric Power Company.

Telephones for Ships.

ARRANGEMENTS have almost been completed by the Tyne Improvement Commission for establishing direct telephone communication with vessels using its docks and staiths on the river. The scheme is expected to be of great service to shipowners, shipmasters, shipbrokers, and exporters, and others having business with ships in port. In accordance with instructions from the Commission, Mr. Richard Aughton, general manager of the River Authority, has negotiated with the Post Office authorities for direct telephone wires to be laid from the North Shields telephone exchange to each of the Whitehill Point staiths and to two coaling berths at the Albert Edward Dock. As each berth will have a separate telephone number, it will be possible for subscribers to ring up any vessel berthed at the staiths at any time during the day or night. Portable instruments, with the necessary length of cable, will be provided, and placed on board any vessel requiring the use of the telephone on her arrival at the staith. The portable telephones will be removed immediately before the vessel leaves the berth.

German Coal.

THE resistance offered by the Germans to the arrangement whereby Italy undertakes to purchase a million tons of coal a year from Great Britain for the railways, was due to the much greater importance which Germany now attaches to the coal trade. Last year coal contributed 36·6 per cent. to the total goods tonnage carried by the railways and 23·5 per cent. to the total receipts. Early in the present year the railways began to apply special preferential rates for the carriage of coal to Eastern Prussia and Pomerania, where the Government also grants subsidies to consumers amounting to 2 marks a ton. This step was rendered necessary by the long deviation of the route in order to avoid passing over the railways in the Polish Corridor. The reduction in the rates for coal is, however, conditional on the traffic exceeding by a stated amount the tonnage carried in 1928. The railways hope that by facilitating the carriage of fuel at lower cost to the consumer, it will be possible to reduce the quantity of British coal imported into Germany. It is fairly certain, however, that the reduction in the rates on coal is to be ascribed more particularly to the fear that the coal traffic will suffer seriously from the plans now being carried out for the distribution of high-pressure gas over the greater part of the country from the coke ovens being constructed in the Ruhr and elsewhere. That scheme is progressing much more rapidly than had been anticipated. In the Ruhr alone, it is estimated that the production of gas from the coke ovens will, in time, reach close upon 1400 million cubic metres a year. Some trouble has been experienced with municipalities producing their own gas, and Cologne and Frankfort-on-the-Main have decided to interest themselves in companies which have been formed to produce coke oven gas at collieries owned by those towns in the Aix-la-Chapelle district. The mains from the Ruhr will, nevertheless, be extended to Cologne, so that the town will be able to rely upon two sources of supply.

The Limpopo River Bridge.

ON Saturday of last week, August 31st, the Earl of Athlone, Governor-General of the Union of South Africa, officially opened the "Alfred Beit" Bridge over the Limpopo River, near Messina, in the Transvaal. The bridge was formally presented to the Governments of the Union of South Africa and of Southern Rhodesia by Sir Drummond Chaplin on behalf of the Beit Railway Trustees. It was designed by Mr. Ralph Freeman, of Sir Douglas Fox and Partners, in collaboration with Sir John Burnett and Partners as architects. The total length is 1560ft. with a width of 32ft., which provides for both rail and road traffic side by side. There are fourteen steel spans, each of about 111ft., which are supported on concrete piers, and the maximum rail height above the bed of the river is 72ft. In times of flood, however, the water reaches to within 3ft. or 4ft. of the top of the piers. The contractors for the construction of the bridge were Dorman, Long and Co., Ltd. The new bridge will be largely used by the increasing motor traffic between Southern Rhodesia and Johannesburg, and the South African Railway Administration has already extended the railway track from Messina to the bridge, and is to continue the line about a mile further into Rhodesia, where a new terminus and township to be called Beitbridge is to be built. The Limpopo River Bridge was built at a cost of close upon £125,000, and it ranks with the Umfolosi River Bridge and the Vaal River Bridge at Fourteen Streams as one of the largest river bridges in South Africa.

Salving the White Star Liner Celtic.

THE task of refloating the derelict hull of the White Star liner "Celtic" is presenting some difficulty to the salvors, Messrs. Petersen and Albech, of Copenhagen, who in this particular work are associated with A. O. Hill, Ltd., of Dover. The liner, it will be remembered, went aground off the entrance to Queenstown Harbour in December last, and all efforts to dislodge her from the rocks which have pierced her hull amidships have as yet proved unavailing. In order to dismantle the ship Messrs. Petersen and Albech secured the services of a large floating crane from Rotterdam, which at first it was proposed to moor on the seaward side of the wreck. It was not found possible, however, to work the crane from that side of the ship owing to the heavy swell, and an effort is now to be made to anchor the crane on the landward side of the "Celtic" and lift the dismantled material on to pontoons by means of a 5-ton crane, which has been installed on the deck of the ship. The dismantled material will be dealt with by the ship-breaking staff at the Haulbowline Dockyard. When the ship was sufficiently lightened it originally was intended to float her by the use of a large number of air vessels, but this course has now had to be abandoned, and, acting on the advice of Mr. E. F. Cox, of Cox and Danks, Ltd., compressed air will be used to lift the hull, and the necessary appliances are being made ready. The work of salvage has so far been greatly hampered by the nauseating fumes and gases from the large amounts of bacon, grain and bunker coal which are still on the liner. In order to counter the fumes large quantities of chemical preparations are being employed under the direction of a member of the staff of Imperial Chemical Industries, Ltd.

The Load-Line Report.

THE report of the Committee appointed by the Board of Trade under the chairmanship of Sir Charles Sanders to advise on the load lines of merchant ships, ships carrying deck cargoes of timber and oil tankers, was published on Tuesday last, September 3rd. With regard to merchant ships the general effect of the new rules proposed is to simplify the procedure of assigning load lines to ships. The general maintenance of the present freeboards obtained by the application of the rules of 1906 is recommended, but anomalies on application have been removed, and the new rules have been modified to take into account the existing conditions in modern ships. With regard to ships carrying full deck cargoes of timber, it is recommended that Sec. 10 of the Merchant Shipping Act of 1906 be repealed, and that fresh legislation be enacted which will allow the Board of Trade to make new regulations to apply to all ships carrying timber deck cargoes when engaged on any voyage at any time of the year. The adoption of a special timber load line is recommended. The recent rapid growth of tanker tonnage is remarked upon by the Committee. In 1906 there were only 190 tankers upwards of 1000 tons gross in the world aggregating 584,231 tons, or 2 per cent. of the steamer tonnage. In June last there were in the world no less than 1236 tankers, of 1000 gross tons and more, representing a total tonnage of 6,987,922 gross tons, or over 10 per cent. of the total steamer and motor vessel tonnage. The Committee has accepted the principle of preferential treatment of tankers in the assignment of load lines, but the amount of deeper loading has been left for international decision. In view of the general understanding that an International Conference on the Load Lines of Merchant Ships will be called in the near future, the adoption of the new rules is to be postponed until the result of that Conference is known.

Transatlantic Telephone Cable.

THE first Transatlantic telephone cable scheme, which will connect London and New York by land and deep-sea lines, and will provide an alternative to wireless telephony, is now being prepared, and the American Telegraph and Telephone Company, which will operate it, has just completed the purchase of land in the West of Ireland for the site of the Irish terminal station. The main link of the cable, which will run from Newfoundland to Annagh Head, in County Mayo, will be, we are informed, the longest submarine telephone cable in operation. Hitherto it has not been possible, it is stated, to send telephone messages over a distance of 1800 miles without the use of intermediate repeating stations, except with such diffusion of the electric signals as to render the voice faint to the point of inaudibility. For this reason no previous attempt has been made to lay a long distance submarine telephone cable. In the proposed new cable the difficulty has been overcome by the use of a new series of alloys as loading material for the cable and the adoption of a new substance known as "paragutta" for insulating the conductor. With these improvements, it is expected that the proposed New York–London cable will give maximum efficiency, with freedom from the variations which are characteristic of radio circuits and with the same degree of reliability and secrecy as is obtained in land telephone calls. It is estimated that the work of laying the cable and completing the land connections will occupy about three years, but it is hoped to expedite the work, so as to bring the new service into commercial use before the end of 1932.

The German Airship Graf Zeppelin.

ON the morning of Thursday, August 29th, the German airship "Graf Zeppelin" completed her world flight, arriving safely at Lakehurst, New Jersey, at 8.13 a.m. The flight, it will be recalled, was made in four stages, Lakehurst to Friedrichshafen, Friedrichshafen to Tokio, Tokio to Los Angeles, and Los Angeles to Lakehurst. The actual time occupied was 21 days and 7½ hours, of which less than twelve days were spent in actual flying. The Zeppelin left Lakehurst for Friedrichshafen on Sunday, and arrived at her terminal base at 2.48 on the morning of Wednesday last, September 4th. The voyage was made in 67½ hours, which time was longer than on previous voyages owing to stormy weather which was encountered in the Azores. The time for the world flight from Friedrichshafen is 20 days and four hours, which sets up a new record for round the world transport by aircraft. On the Atlantic voyage the ship was piloted by Captain Lehmann, as Dr. Eckener remained in New York to discuss the constitution of two large Zeppelins for Atlantic service. It is also stated that work on a much larger airship will be begun at Friedrichshafen as soon as the new large airship hangar is completed.

The Rapid Coaling of Power Stations.

THE London, Midland and Scottish Railway Company has just ordered from the Birmingham Railway Carriage and Wagon Company thirty 40-ton self-discharging wagons, which will be employed to transport coal from the pits to the company's Stonebridge power station which supplies current for the Watford electrified lines. The wagons, which will be constructed to the design of Mr. E. J. H. Lemon, the company's carriage and wagon superintendent at Derby, will each have a capacity of 1794 cubic feet. They will weigh about 19 tons unloaded, and be 32ft. in length, with a width of nearly 9ft. and a height of 10ft. 9in. As self-dumping attachments are to be fitted it will be possible to unload and clear the train of thirty wagons in half an hour. Although the wagons have been ordered primarily for the company's own use, it is understood that the results will be carefully analysed and compared with continental practice. If the scheme is successful, it is expected that the company will recommend the increased use of these high capacity wagons for coal or ironstone traffic. If this is done it will be necessary for colliery undertakings to adapt their screening plant and sidings to deal with the larger trucks.

New Engineering Plant and Heating Arrangements at a Union Institution.

THE engineering plant and heating arrangements at the London-road Institution at Stoke-on-Trent, of the Stoke and Wolstanton Union, have recently been entirely remodelled. The Institution, which was originally founded in 1836, has accommodation for 1154 persons needing indoor relief. It has a total floor area of some 300,000 square feet, and is of the "mixed" Poor Law Institution type, that is to say, it takes in hospital and mental patients, aged and infirm persons, and others, the different classes of inmates being housed in separate buildings. The number of hospital beds is 741.

In 1904 the various buildings were lit by electricity, the necessary current being generated on the site. That was the first step taken to modernise the establishment, but the arrangements generally had, a few years ago, become very inefficient. There were no less than twelve boilers at work, the exhausts from all the engines were blown to waste, and the coal consumption amounted to 3500 tons per annum. That taken out and either cleaned and refixed, or rejected and replaced. Hence when, three years ago, the old boilers were condemned by the Insurance Company, the Board of Guardians, acting on the advice of their consulting engineers, Messrs. Edwards and Shaw, of Birmingham, decided to take advantage of the fact that new boilers had to be installed, and remodel the whole equipment.

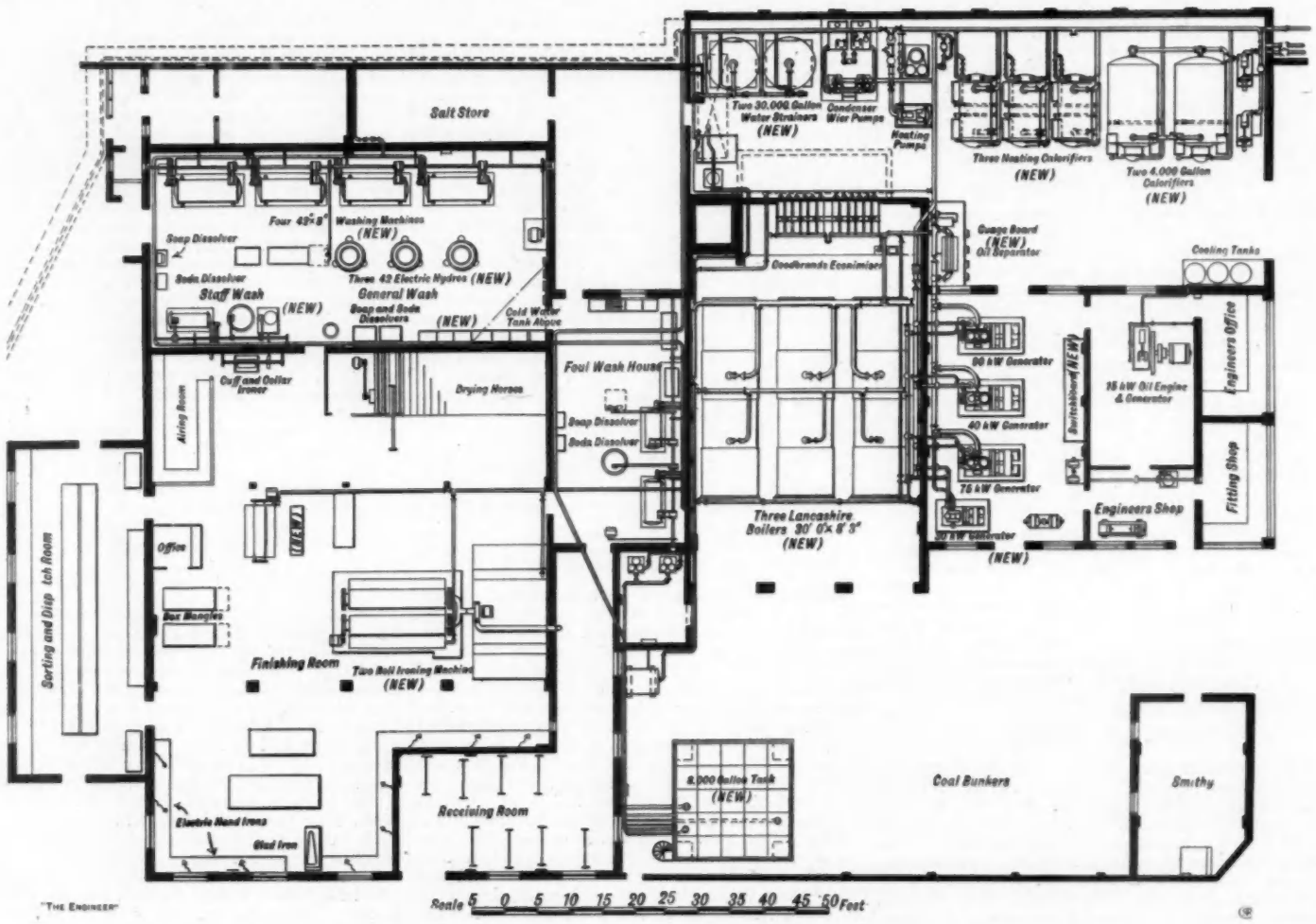
To begin with, the original boilers had to be taken out and replaced with more efficient steam generators. The new plant comprises three Lancashire boilers, each 30ft. long and 8ft. 3in. in diameter, made by H. and T. Danks, Ltd., of Netherton. They are designed for a working pressure of 160 lb. per square inch, as compared with the 100 lb. per square inch of the original boilers. Two of them are fitted with furnaces, made by J. and J. Neil, Ltd., of Glasgow, which embody rocking fire-bars and a bridge at the back of the furnace designed to prevent the emission of smoke. The other boiler is fitted with a Crosthwaite forced draught furnace. Hays draught gauges, and flue temperature recorders made by Negretti and Zambra, Ltd., are employed. As a fact, we gather that neither type of furnace has been entirely successful from the point of view of smoke prevention, as the existing chimney is incapable of providing an adequate draught. A new chimney, 180ft. high, is, therefore, now being built. A Goodbrand economiser having 192 tubes is fitted at the back of the boilers. It is capable of raising the temperature of the full volume of feed water to 280 deg. Fah. The feed pumps, which are actually the same machines that were used in the original plant before the remodelling, were made by G. and J. Weir, Ltd., of Glasgow.

All the steam used for every purpose, including the engines, calorifiers, pumps, laundry, kitchen, operating theatre, disinfector, &c., is measured by Kent's steam meters. In actual practice, so we are informed, the combined readings of these meters correspond very closely with the feed water as measured by a Lea recorder. The reading of this recorder is logged at the end of each stoker's shift, together with the weight of coal fired on the boilers during the period.

The Institution receives its water from three sources:—The Staffordshire Potteries Water Board, and two wells, known respectively as the School Well and the House Well. The major portion of the water used is obtained from the Water Board, and it, alone, is used for drinking purposes and for feeding the boilers. The water from the School Well contains 20 deg. of hardness and traces of free carbonic acid. It is raised from the well by a new three-throw Tangye pump. The House Well water has 14 deg. of hardness. The water from both these wells is softened and is used solely for the domestic hot water service. For effecting the softening, two Zeolite water softeners, made by the Kennicott Water Softener Company, Ltd., have been installed as part of the remodelling scheme. Each has a capacity of 30,000 gallons between regenerations, and they treat the boiler feed water in addition to that for the hot water service. With water softened by the base-exchange process, no scale is formed, but if water were not blown off from the boilers, the water in the latter would become a concentrated solution of caustic soda. The temperature of the blow-off water is normally about 350 deg. Fah., and to obviate the loss which would result from delivering water at that temperature direct to the sewers, a continuous blow-down apparatus, made by the Neckar Water Softener Company, has been fixed. With this apparatus no more water than is necessary is blown off, and a large amount of heat is conserved and returned to the feed water.

The new battery of calorifiers is housed in an entirely new annex or wing to the main machinery building, which replaces a shed that housed the original heating plant. It is seen at the right top corner of the accompanying plan. The heating and hot water services are kept entirely separate. For heating purposes there are three heating calorifiers, which are fitted with batteries of pipes for both exhaust and live steam, the exhaust steam battery being at the back and the live steam battery at the front end of the cylinder. The live steam is under automatic control. For the hot water service there are two calorifiers, each having a storage capacity of 4000 gallons, which were made by Wright's Forge and Engineering Company, Ltd., of Tipton. In each of these cylinders there are two batteries of copper tubes. The lower battery, which is supplied with exhaust steam from the engines and pumps, is normally the only battery in use, except at times of heavy draw-off. An automatic temperature regulator, made by the British Arca Regulator Company, of London, admits live steam to the battery, should the temperature fall below the predetermined temperature, and continues to do so until the temperature of the water in the cylinder reaches normal, when the supply of live steam is automatically cut off.

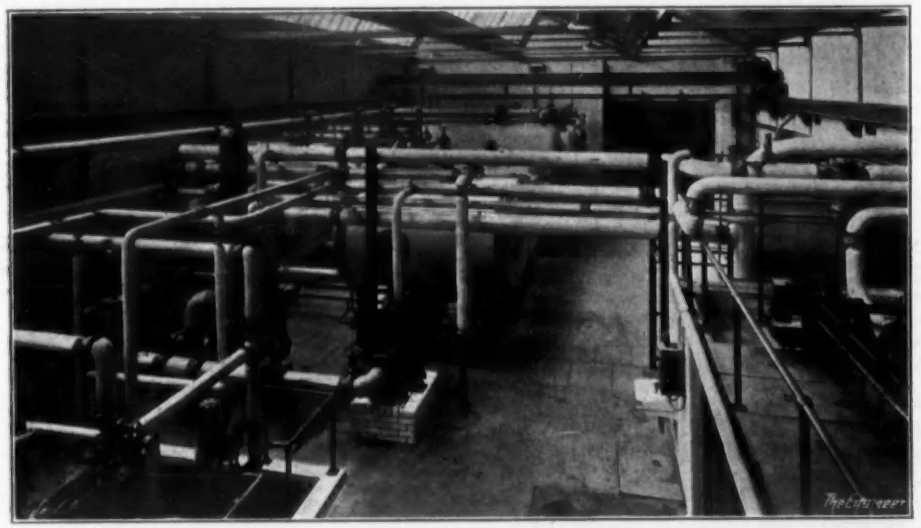
The hot water is pumped round the whole Institution to every draw-off point by means of Mather and Platt centrifugal pumps driven by turbines made by Haywards Engineering Company, Ltd., of Westminster. Stand-by turbines and pumps are provided. A somewhat unusual feature in connection with the hot water service is that some of the draw-off taps and baths are at a higher level than the service tank. All the exhaust steam has to pass through a Holden and Brooke oil separator before entering the calorifiers. All the water condensed in the calorifiers has to pass through steam traps made by Royles, of Manchester. The clean exhaust goes into a hot well



PLAN OF ENGINEERING DEPARTMENT AND LAUNDRY AT LONDON ROAD INSTITUTION, STOKE-ON-TRENT

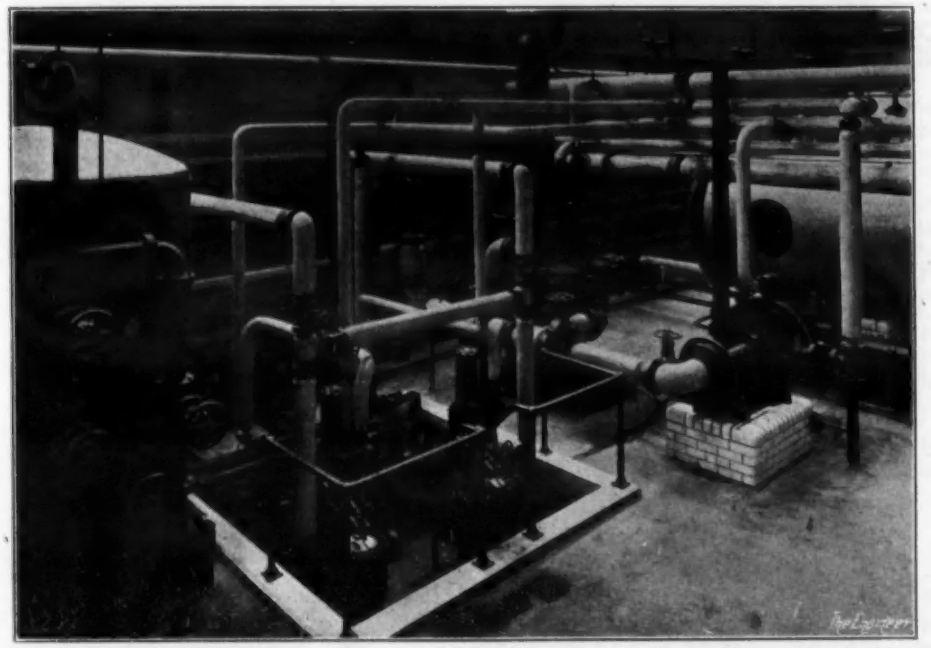
ENGINEERING PLANT AT LONDON ROAD INSTITUTION, STOKE-ON-TRENT

HEATING CALORIFIERS.



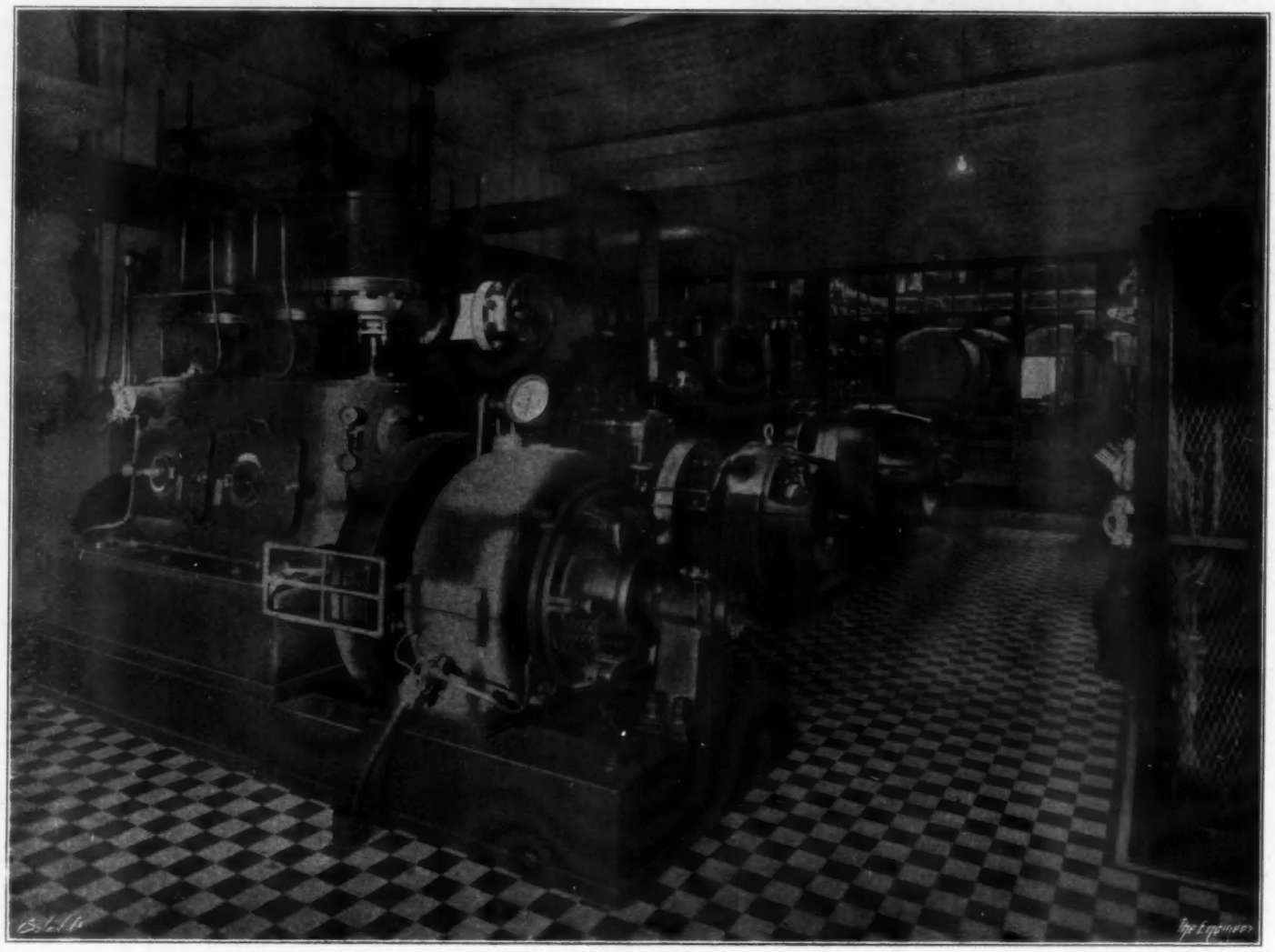
CONDENSED WATER PUMPS AND HOT WELL

INSTRUMENT BOARD AND CALORIFIERS

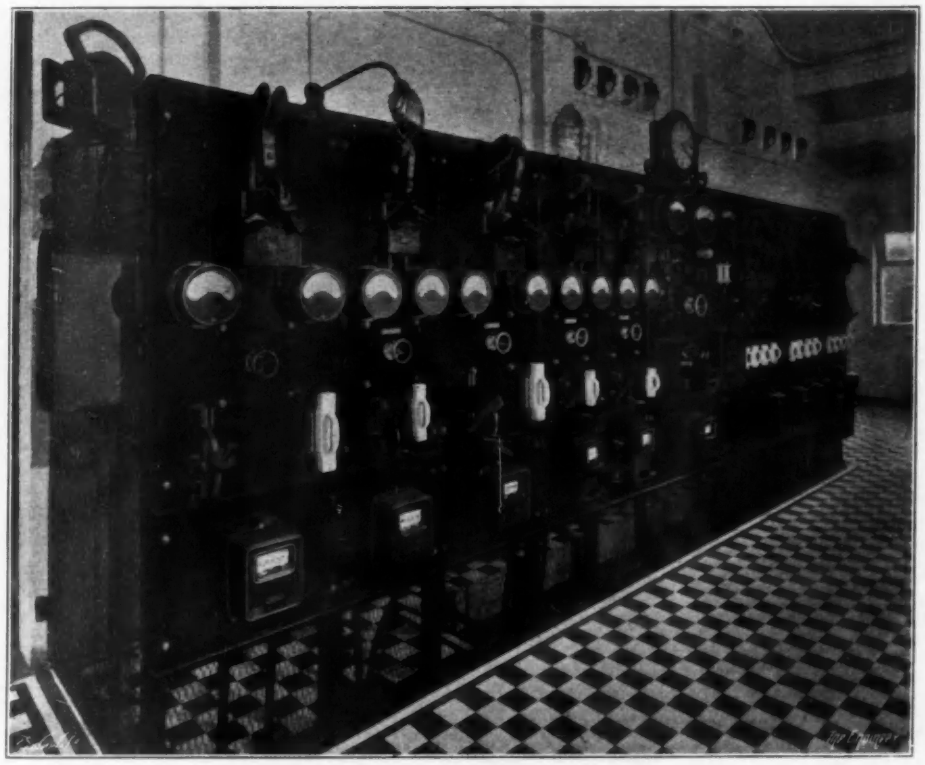


WATER SOFTENER, CONDENSER PUMPS AND HEATING TURBINES

GENERATOR SETS IN ENGINE HOUSE AT STOKE-ON-TRENT INSTITUTION



in a pit, from which it is pumped automatically by a Weir pump into an overhead tank to the left of the calorifier house, which tank forms the boiler feed reserve. All the hot water pipes and vessels are encased in magnesia covering. The covering work was partly done by Newall's Insulation Company, Ltd., of Newcastle-upon-Tyne, and partly by Bell's United Asbestos Company, Ltd., of Birmingham.



SWITCHBOARD IN ENGINE HOUSE

The problem of changing over from one system to another without any serious interruption of the service was not easy of solution, but it was successfully effected. The hot water service was never disconnected in any part of the Institution for more than a day, and the new system was actually at work two months before the date promised for completion. When it is considered that, in addition to the cleaning and renewing of pipes, radiators, &c., and the replacement of the boilers, there were the raising of both floor and roof of the boiler-house, the making of a new central heating chamber, the providing of a complete series of trenches round the buildings, to say nothing of a considerable amount of work which had to be carried out in the buildings themselves, it must be admitted that to complete the change over during one summer was an excellent achievement.

As giving an idea of the magnitude of the installation, it will perhaps be of interest to record the weights of live steam used in the various departments per week. Such careful records are kept that we are enabled to give this information with considerable accuracy.

Department.	Live steam used per week. Summer. lb.	Winter. lb.
Kitchen	113,000	131,000
Heating and hot water service	423,000	850,000
Laundry	110,000	122,000
Disinfector, operating theatre, &c.	55,000	126,500
Engines	244,000	411,000
Turbines	101,000	232,000
Totals	1,046,000	1,872,500

While the remodelling was being discussed, the question as to whether it would be cheaper for the Institution to continue to generate its own electrical energy or to purchase it from the Stoke-on-Trent Corporation had to be determined. The matter was very carefully gone into by the consulting engineers, who ascertained by actual experiment that, by using the exhaust steam from the prime movers in the calorifiers, a saving in coal consumption of 5½ tons per day was effected. Because of that fact, and also because there was already at work a considerable amount of electrical machinery, it was proved that the cost of generating current by the Guardians, including the interest and depreciation on the capital cost of additional generating plant which it was necessary to install, would be much less than any offer which had been made by the Corporation. Furthermore, if current had been purchased from the Corporation, a large additional capital expenditure would have had to be incurred in installing new main cables throughout, so as to balance the load on the three-wire

PACKETTING MACHINE FOR TEA

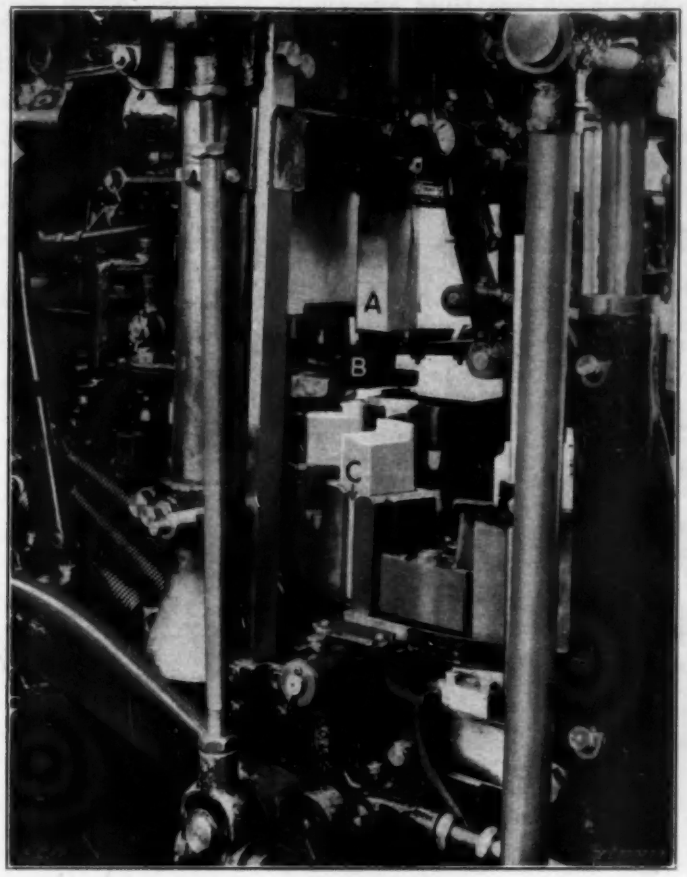


FIG. 1—BAG-FORMING MECHANISM

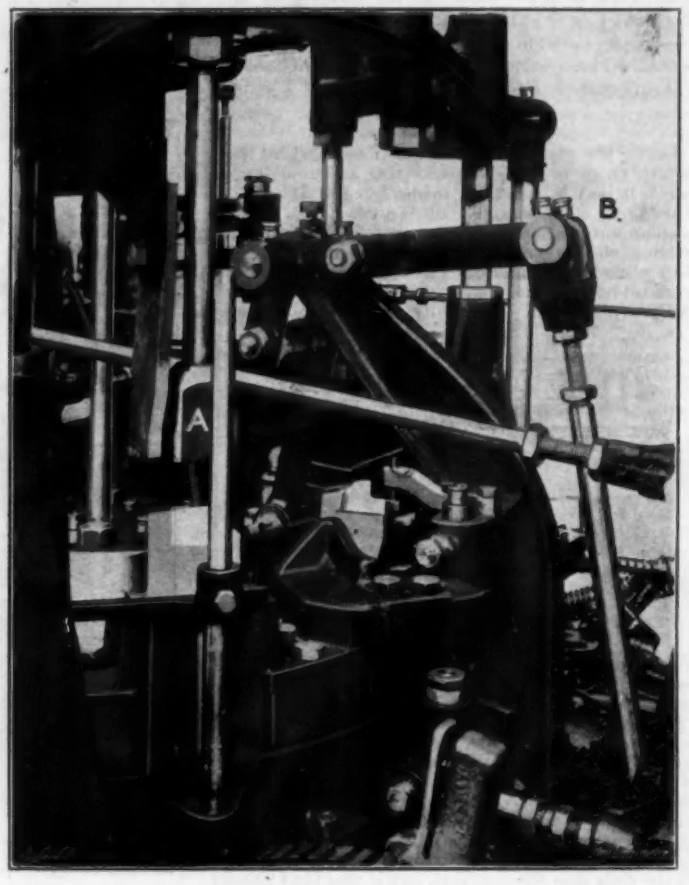


FIG. 2—RAMMING MECHANISM

system. In short, careful estimates showed that the capital cost of a change over to the Corporation electricity supply would, owing to the large area covered by the scattered buildings, be greater than the cost of additional engines and dynamos. Actually, we understand, the present cost of electricity generated at the Institution, including interest and sinking fund on all outstanding loans on the station equipment is 1·7d. per unit. The best offer made by the Corporation in 1926, when the reorganisation was decided upon, was 2·54d. per unit.

The plant installed in 1904 comprised one 75-kW and two 35-kW generating sets by Alley and MacLellan, Ltd., of Glasgow. The large set ran until April of this year. The present generators are two 90-kW, one 60-kW, and one 40-kW sets, all Belliss-Crompton combinations. The last named is for night and Sunday work. In addition, there is a Blackstone oil engine driving a 15-kW dynamo, which was purchased some three years ago, when a storage battery was discarded. This set was found to be of very considerable service in providing power and light, at times, during the reconstruction period, when all steam had to be shut off for the purpose of coupling up the new steam mains, &c. The addition of these further sets necessitated the entire reconstruction of the switchboard, and it was done by Mudies Electrical Company, Ltd. Another necessary addition was an enamelled slate instrument board, which accommodates recording instruments to register, on weekly charts, the steam used in all the departments, steam pressure recorders, which give on their charts the pressures of supplies to the various portions of the engineering plant, laundry, kitchen, &c., and instruments for keeping a constant record of the flow and return hot water service temperatures.

The original contract for the work as specified was for the sum of £28,757. The actual sum expended was, we understand, £30,095, but that included the renewal of a number of radiators which were found to be defective, the replacing of old mains which it was found impossible to clean out, the remodelling of certain heating circuits, and numerous other small additions.

Concurrently with the remodelling work outlined in the foregoing, it was decided to reconstitute the laundry, the machinery of which, after some quarter of a century's work, had become more or less worn out or obsolete. New machines were therefore installed to replace or supplement the then existing plant. This work was done without interfering with the usual routine work of the laundry.

The new equipment includes four belt-driven 84in. by 42in. Braithwaite washing machines, and three under-driven electric hydro-extractors, made by Broadbents, of Huddersfield. A British Arca automatic control regulates the temperature of the inlet water to the flannel washer, so as to obviate the shrinking of woollen goods, such as blankets, &c., which may easily take place as the result of careless treatment and the use of water at too high a temperature. The finishing-room is equipped with suction ironing machines made by Thorp Medley, of Pendleton, and Manlove, Alliott, of Nottingham, and glad irons by Lister Brothers, of London. The output of the laundry is now 30,000 articles per week, and the cost of washing, including steam, water, soap, consumable materials, labour, &c., is, we are informed, 75d. per 100 articles.

Another innovation was the installation of air-filtering appliances made by the Visco Engineering Company, of London. The temperature of the hospital operating theatre can be varied at will to anything up to 80 deg. Fah., and clean air can be introduced in such quantities as to replace the whole of the air in the theatre every five minutes.

The architect for the new portions of the buildings was Mr. W. Pendleton, of Stoke-on-Trent; the builders were Palin Brothers, of Tunstall; and the contractors for the whole of the engineering work were Messrs. Couzens and Akers, Ltd., of Birmingham.

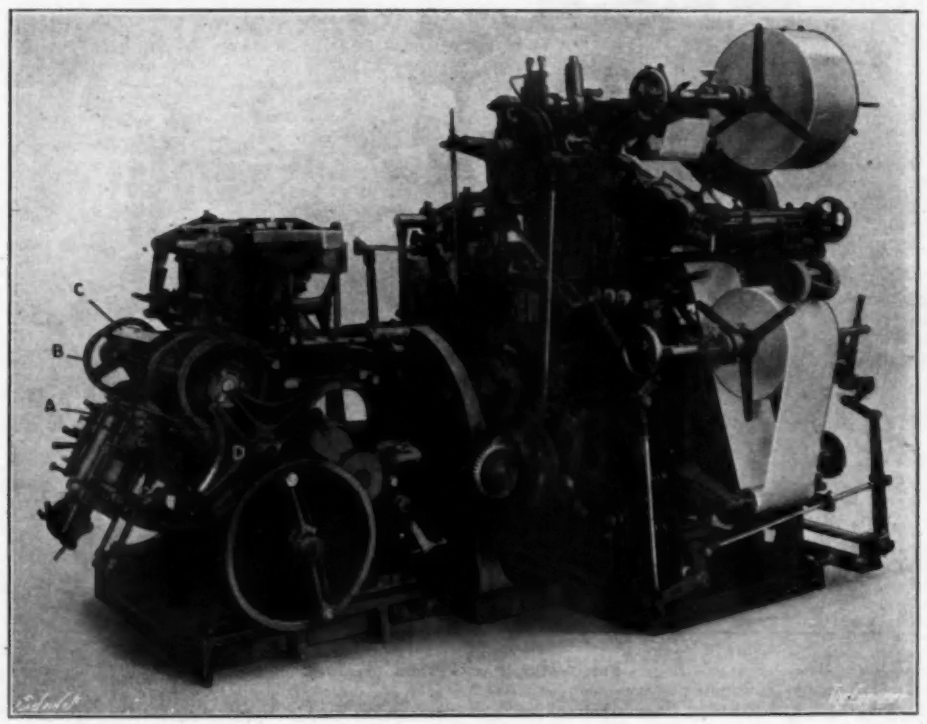


FIG. 3—TEA PACKETTING MACHINE

North-East Coast Exhibition.

No. VII.*

THE PALACE OF INDUSTRIES.

THE Palace of Industries at the North-East Coast Exhibition resembles the Palace of Engineering, but the floor area is considerably larger. It is made notable, as far as engineering is concerned, by the exhibits of the Co-operative Wholesale Society, which

* No. VI. appeared June 21st

shows in operation complete plants for the manufacture of boots and shoes, sweetmeats, cakes, &c., while there is other plant for the canning of an effervescing salt. These machines, as well as a few others to be found in the Palace, present features of mechanical interest, and we propose to describe some of them briefly in a few articles.

Tea Packetting.

Among the more interesting machines used by the Society there is the tea packetting machine illustrated herewith, which is made by Job Day and Sons, Ltd., of Beeston Royds Works, Leeds. This machine automatically makes paper bags, fills them with tea, closes them and affixes a label at the rate of sixty packets per minute. The tea is supplied from overhead hoppers, not shown in our engravings, which are provided with electrically operated weighing

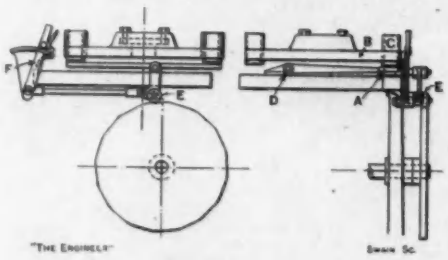


FIG. 4—VIBRATOR

devices for portioning out the tea into exact amounts for each package. These weighers are interconnected, by means of solenoids, so that the flow of tea is stopped if the supply of wrapping paper fails, and *vice versâ*.

The coils of paper are plainly shown in Fig. 3, one above the other. It is almost the invariable rule to have two coils, as the bag is made of two thicknesses, a light impervious lining and a stouter outside wrapper; or a combination of metallic foil and paper may be used. In the earlier examples of this machine it was the practice to draw the paper directly off the coils into the machine, but it was found that with very thin papers there was a liability for the band of paper to be broken, as the feed is, naturally, intermittent, only the amount necessary for one bag being taken off at a time. In order to overcome this difficulty, one of the paper bands, the lower one in this case, is led round an idler roll, which can be seen near the bottom of the machine. This roll is carried on a pair of arms, and is given a vertical reciprocating

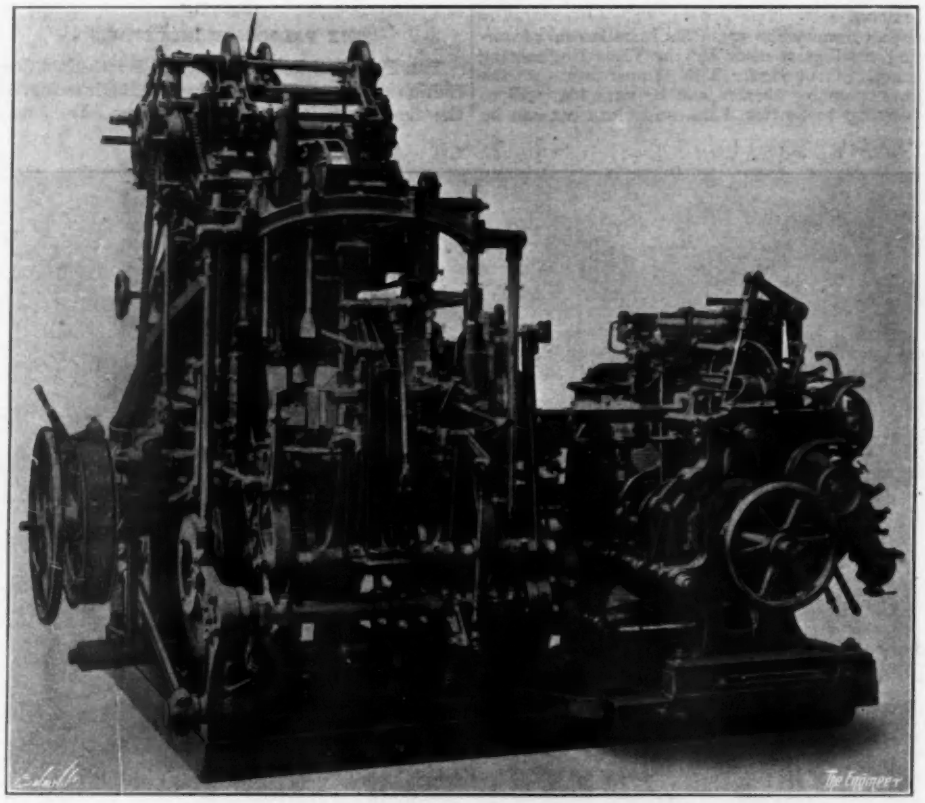


FIG. 5—TEA PACKETTING MACHINE

motion in unison with the rate of bag making. During the time occupied in making a bag the forward feed of any more paper must, obviously, be stopped, so the feeding rolls, hidden in the recesses of the machine in Fig. 3, cease to rotate, but they continue to grip both bands of paper. At this time the idler roll already referred to makes its downward stroke gently, and draws enough paper off the coil to make the next bag. As the coils are quite free to rotate, very little resistance is offered to this motion. The next cycle of operations then starts, the feeding rolls pull the paper forward, and the idler roll rises again quickly as the bight of paper around it is drawn in by the feed. On account of this arrangement, the paper band is relieved of the sudden snatch which the feeding rolls would give to it if the inertia of the whole coil had to be overcome at the moment of starting each feed. It is unnecessary to provide this mechanism for the upper coil, as the paper there is stronger.

The two bands of paper are fed forward together over guides which lead them into the next part of the machine, vertically downwards, to be folded to form the bag. The correct length of paper is cut off by a horizontally reciprocating guillotine, and is delivered alongside a vertically depending former—see Fig. 1. This former is a piece of rectangular tube and is marked A in the engraving.

As soon as the two flat sheets of paper have been placed alongside the former, two vertical plates advance edgeways, pressing the paper round two sides

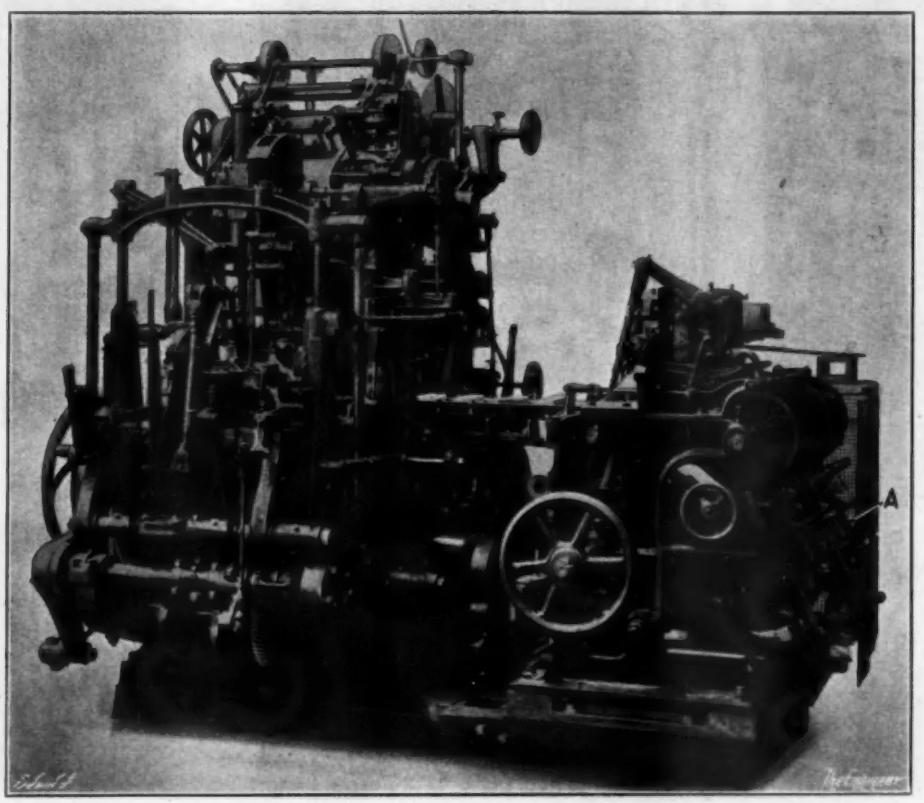


FIG. 6—TEA PACKETTING MACHINE

of the former. Two other arms then approach from either side, one slightly after the other, and wrap the overlap of the papers round the back. The bottom of the bag is then closed by three little fingers which successively swing upward and push the paper over into the familiar form of triangular folds. Immediately these folds have been made, a foot or support B—see Fig. 1—rises and "cracks" the paper round the edges. As a matter of fact, it does not actually break the paper, but the term is used to denote the action of pressing the folds so tightly together that they have not much tendency to reopen.

The main point to be considered in the next operation is the method of filling and stripping the bag off the former, and the subsequent method of agitation and ramming, so as to produce a firm packet without crushing or bruising the tea.

The foot remains under the bag, and the weighed amount of tea is fed down the hollow interior of the former. It will be appreciated that the charge of tea now stands on the bottom of the bag, but is contained by the hollow former, which, in turn, is surrounded by the bag.

The foot now descends, with the bag full of tea, which it deposits in a mould below. In order to permit this movement, the side of the mould has a vertical slot—as shown at C—to accommodate the arm supporting the foot in its descent. The mould into which the packet is dropped is one of several arranged round the periphery of a turntable, within which it is free to slide vertically, but is supported by another table beneath.

The tea, as it is poured into the bag, is, naturally, rather loose, and requires consolidation to produce a firm packet. This consolidation is effected by a process of agitation and ramming.

On reference to the drawing—Fig. 4—it will be seen that the table A beneath the turntable B which supports the moulds C, is carried on a pivot D. At the opposite side it is carried by a link and roller E. This roller rides on a large wheel, which has a number of flats cut on its periphery, and consequently jolts the table vigorously as it rotates. The extent of the vibration may be varied from the maximum to nothing, by means of the quadrant lever F. This vibrating under-table extends for approximately one-third of the circumference of the turntable, so that during their passage through this distance, the moulds are constantly vibrated and the tea is correspondingly consolidated.

The rotation of the turntable is, of course, intermittent, as it must be held stationary whilst it receives each successive bag from the former. At two of the stations where the mould stops, after having received the filled bag, the tea is subjected to a ramming action, consecutively, by two rams, which depend from the bow-shaped yoke, forming a prominent feature in Fig. 5. These rams can be seen on the left. One is a comparatively small diameter round

rod, while the following one has a head that fits the bag neatly and produces a firm flat surface on the charge of tea. After passing through these processes, the moulds slide off the vibrating under-table on to a fixed table, but are still held in the turntable. The tea has now been well compacted, and the next operation is the closing over of the top of the bag.

On reference to Fig. 2 there can be seen plainly at A the second ram, while some parts of the top folding mechanism are shown immediately on the right. The first movement of the folding is effected by the bell-crank lever B, which, on rising at the end B, pushes a blade across the top of the bag. This blade folds down the projecting side of the bag on which the papers overlap. It should be remembered that during the half rotation of the turntable the bag has been reversed in aspect. Two pads then approach sideways, one after the other, and fold over the sides of the bag so as to leave a triangular upstanding part at the front. This part is, in turn, pressed down and is held secure by a little finger until the mould comes under another ram attached to the bow-shaped yoke referred to in connection with Fig. 5. This ram "cracks" the paper again in the same way as were the bottom folds, and ensures the package keeping its form.

At this stage the packeting proper is really completed, but it will be readily appreciated that, with a material like paper, folded dry, the packet would have no great life; so it is transferred to another part of the machine, where it receives a gummed label that serves the double purpose of holding the folds together and providing a printed description of the contents.

Before passing on to the labelling machine the packet is laid on its side, as this is a more convenient position in which to apply the labels. For this purpose it is ejected from the mould and put in a cradle which oscillates through a right angle from the vertical to horizontal. In the horizontal position it arrives opposite a conveyor leading to the labelling mechanisms. Each packet is fed forward separately, and is not pushed forward by its successor. As the packets go forward they pass under a lever, which lightly bears on their upper faces. This lever is connected with the label-supplying mechanism in a manner to be described later, and prevents a label being delivered in the event of the corresponding packet being missing. Not only does this arrangement prevent the waste of the labels, but also eliminates the possibility of the machine being choked with gummy labels if the supply of tea in the hoppers runs out.

At the end of the conveyor the packet is placed on a little table supported by a ram. Above, there is what might be described as a chimney up which the packet is pushed with one side leading. Before it goes up, however, a gummed label is placed across the top of the packer. This label projects at either end, and the act of pushing it up the chimney folds over these ends to seal the ends of the packet. On arriving at the top of the chimney the packet is ejected endways and is taken away to the packing department.

The labels are supplied by a mechanism which is shown on the extreme left in Fig. 3, and on the right in Fig. 6. The labels are contained in a slightly inclined box, marked A in both views, and are packed with their printed sides downwards. In line with this box there is a spindle—see Fig. 3—on either end of which there is a wheel B which, it will be noted, is not truly circular, but has two flats on opposite sides of the diameter. Against these wheels there bear rollers connected with the bearings of a gumming roll. This gumming roll is mounted in swinging bearings controlled by springs, so that it always follows the contour of the wheels B and is, incidentally, kept in contact with another roll that dips into a trough of aglutinant. In this way the gumming roll is constantly supplied with adhesive, but it only comes into action when required in the following manner:—

In line with the flats on the wheels B there are two pads, one of which is shown at C, that closely resemble the shape of the label. As the spindle rotates these pads are presented to the gumming roll, on account of the flats on the wheels B, and receive a smear of gum. During this part of the cycle the rotation of the pad spindle is continuous, but when either one of the two pads arrives opposite the label magazine its rotation is stopped by means of the main driving cam D, the operation of which is familiar to engineers.

At the moment when the gummed pad is opposite the labels, the rotary action stops and the magazine is brought forward to press the top label against the gummed pad. The magazine retreats and the pad spindle continues its revolution with its label attached by the gummed side.

It is noteworthy, in this connection, that the pad has not quite the same area as that of the label itself, for the following reason. If the adhesive were applied to the whole of the surface of the label, some portion of the gum would inevitably be extruded during the subsequent folding operation, and might tend to the glueing together of adjacent packages. As a consequence, the pad which applies the adhesive is slightly smaller, both as regards length and width, than the label, and when the label is put in place the gum is squeezed out to come out to the edges.

This peculiarity has the merit that it provides an ungummed margin at the ends of the label as it is taken from the magazine, of which advantage may be taken for its transfer to the actual labelling position without its stickiness interfering with the operation.

After a label has been impressed on the gummy pad, by a momentary rise of the magazine, the pad spindle rotates through approximately half a revolution and two pairs of pincers catch the label by the ungummed extreme ends. These pincers are carried on arms which transfer the label to the position already mentioned above the packet of tea, prior to its passage up the chimney.

It now becomes plain how the label saving device acts. The lever which rides on the top of the packets as they come along the conveyor is connected with another lever, which gives the label magazine its reciprocating stroke. If a packet is absent in the row coming along the conveyor, the lever drops and the magazine makes a short stroke, so that the labels do not rise far enough for the gummed pad to pick one up. The lever is, of course, placed in such a position that its action synchronises with the picking up of the appropriate label.

In the foregoing notes we have made no attempt to describe in detail the mechanism by means of which the various movements are effected, and it is sufficient to say that they are derived from two main cam shafts, one for packeting and the other for labelling. Ball bearings are used extensively, and the cam rollers are of hardened steel, so that the machine can be run continuously for long periods without adjustment. The supplies of paper and labels can be very conveniently and quickly renewed, and one attendant can keep the machine running at full capacity.

It is noteworthy that although there are so many moving parts in the machine a man can easily pull it over by hand, and that running at full speed it requires only about 2 horse-power. It measures 7ft. 6in. by 6ft. 6in. and weighs 2 tons.

(To be continued.)

Industry and Research.

AT a public meeting of the British Association for the Advancement of Science Congress, at Johannesburg, on August 2nd, the Hon. H. Mond, in the course of a discussion on "Science and Industry," said that if there were a manifest one to one correspondence between the prosecution of scientific research and industrial success the complaint of the general neglect of science, especially in Great Britain, would speedily disappear. Everyone knew that what were at the time apparently casual and interesting observations had eventually become foundations of great industries. The electrical experiments of Faraday were the germ of a growth which had gone a long way towards revolutionising civilisation as we knew it.

Another similar instance he could cite was the nickel carbonyl process, invented by his grandfather, the late Dr. Ludwig Mond. It was commonly supposed that the accidental discovery of the corrosion of a nickel valve led to the isolation of that truly remarkable compound nickel carbonyl, and that the idea straightaway suggested itself that there lay the foundation of a new and valuable process. How far that was from being true was shown by the following quotation.

"For a long time while we were engaged in investigating the physical and chemical properties of this interesting substance—which was without parallel in the history of chemistry—and while we were endeavouring to obtain other similar compounds with other metals, I had myself no suspicion that this substance, which was until then only obtainable by very careful and elaborate laboratory manipulations, should ever become available for industrial purposes. But the longer we went on preparing it for our investigation, the more easy we found it to prepare it in quantity, after we once knew exactly the best conditions for so doing. After that I came to the conclusion that it ought to be possible to make use of the ease with which nickel is converted into a volatile gas by CO, while practically all other metals, and notably cobalt (which is so difficult to separate from nickel by other methods) was not acted upon by this gas, for separating nickel from cobalt and other metals on a manufacturing scale, and for obtaining it in a very pure state."

The general attitude of modern industry towards research was, of course, unexceptional, but industrial research was exposed to big dangers, said Mr. Mond. There was, for example, a tremendous drift towards administration which is always accentuated during a period in which an industry was expanding. The driving force behind any research department should be scientific enthusiasm, for it was only by enthusiastic alert research workers that discoveries would be made. There was another extraordinarily important factor, namely, that of technique. If an analysis were to be made of all the researches which had been conducted, it would be found that by far the greater majority of them had been carried out under fairly easily obtainable conditions.

"Let me give you," Mr. Mond said, "an example from my own industry. Until after the war there was not in Great Britain any volume of chemical industry which operated at high pressure, the reason being that the average chemist had not the technique to face such operations. As you know we have now at Billingham, in the County of Durham, an enormous high-pressure industry for the production of fertilisers, which parenthetically this year will produce three-quarters of a million tons. This industry is founded upon a high-pressure technique, and that high-pressure technique is due to the extraordinary engineering skill and reliability, especially the latter, which has always been a feature of British engineering. Our technical staff having once mastered the high-pressure technique are now applying it in all sorts of other directions. One of the best known of these is, of course, the synthesis of methanol.

PETROL FROM COAL.

"But there is another and far more important matter to which high-pressure technique is applicable. I am alluding to the production of oil from coal. This great problem, which is of paramount importance to the British Empire, is rapidly approaching solution in the great company of which I have the honour to be a director (Imperial Chemical Industries, Ltd.). After all the necessary preliminary experiments on the laboratory scale we have succeeded in producing petrol of the highest quality in what might be called a pilot plant. The experience gained in this plant is being rapidly applied to the development of a large unit, and I have no doubt that before long the production of oil from coal will be an established industry in Great Britain. It is a great mistake to assume that British chemical research and engineering is incapable of or behind any of its competitors in this great problem. I can assure you this is very far from being the case."

Continuing, Mr. Mond said that agriculture, even in Great Britain, was the greatest industry. It was incomparably the greatest industry in the British Empire. The use of artificial fertilisers had opened out a vista of agricultural possibilities which two decades ago would have seemed literally impossible. Imperial Chemical Industries was on the point of inaugurating at Jealott's Hill, near Maidenhead, an agricultural research station which was to be a central link of a vast chain of such institutions throughout the Empire. Now for the first time the immense technical resources of industry were enlisted in the service of the farmer.

The chemical industry in general, it might be claimed, showed as enlightened or possibly a more enlightened attitude towards science than any other. Not only did Imperial Chemical Industries maintain four enormous research departments constantly employed in working out immediate and future problems in connection with chemical industry, but it also encouraged academic work to an extent which was not fully realised by the general public. If the British Empire was to advance in the future in the manner in which it had done in the past, it will be necessary for all first to get into their minds a genuine belief that science and scientific work would always produce further progress, and having attained that belief to implicate it by every means in their power.

SIXTY YEARS AGO.

SOMETHING of a revival of the whale fishing industry is in evidence to-day. At the end of July, on the North-East Coast, no fewer than twenty-seven whalers were on the stocks or being fitted out, while three large liners were being converted into whale oil factories and a fourth vessel of the same type was being built. In the South Wales district there is also considerable activity in the fitting out of vessels for the industry. Sixty years ago the conditions under which whales were captured were still those described by Melville in "Moby Dick," but a beginning was being made with the introduction of new methods, methods the subsequent development of which has, it is feared, made serious inroads into the world's stock of whales. Inventors were at work chiefly on improvements designed to replace the traditional hand-thrown harpoon. One inventor with characteristic faith in the newly discovered forces of electricity proposed to fire or throw a light harpoon at the whale, and when contact was made to paralyse the animal by transmitting to it a shock of electricity from a battery and induction coil. The inventor, Mr. H. J. Rogers, had, it seems, secured encouraging results from tests carried out on eels and other small fish, but Mr. Robert Anderson, a gentleman closely associated with the Dundee whaling industry, would not accept the idea as practicable. In our correspondence columns they carried on a discussion, the interest of which to-day lies almost entirely in Mr. Anderson's contributions to it. In our issue of September 3rd, 1869, he described an alternative improvement, the invention of a practical American whaleman, which had been, he said, proved fully successful by experience. This invention consisted of a form of gun fired by the harpooneer from his shoulder. The projectile, consisting of a rocket and an explosive charge, carried folding barbs and was attached to a rope which it pulled out on its flight. A ten-seconds fuse allowed the rocket to penetrate the flesh of the whale before the charge exploded, killing the whale instantly. The folding barbs expanded when the rope was pulled and retained hold of the animal. With this device, Mr. Anderson stated, it had been found possible successfully to hunt the sulphur-bottomed whale, a species which, by their fleetness and by reason of their peculiar characteristic of sinking when killed, had never before been captured. Off Iceland in 1866 Mr. Anderson's ships had taken forty-six whales by means of this invention, and in the following year forty were captured. Not a boat was lost and not a man was injured, a record for any whaling company. The gun, Mr. Anderson said, was as easy to handle as a rifle. Each shot cost about £3, which, he maintained, was not a heavy expense when the whale captured might be worth from £300 to £500. So securely was the attachment made to the whale that after its death it could, if it sank, be hauled to the surface without risk of losing it.

A COMPREHENSIVE plan of research into the industrial applications of tin, including its properties as a preventive of corrosion and its economic use in the production of more efficient high-speed machine bearings, has been announced by the hon. secretary of the Tin Industrial Applications Committee. The Committee was recently formed, in direct co-operation with the British Non-ferrous Metals Research Association, to investigate the properties of tin, with a view to standardising its most efficient applications for industrial purposes and to finding new uses for the metal. "Corrosion costs the world at the present time some £500,000,000 a year," says the hon. secretary. "The line of investigation now being undertaken is expected to develop a new and successful preventive. A recent discovery discloses that by mixing a small amount of tin with lead and adding a smaller quantity of another non-ferrous metal, the strength of the lead is increased enormously, as is its resistance to corrosion and cracking."

The First Arc-Welded Bridge in Europe.

By STEFAN BRYLA, C.E., D.R.T., Professor of the Technical University, Lwow, Poland.

THE first welded road bridge in the world and the first arc welded steel bridge in Europe was erected for the Polish Government near Lowicz, over the river Sludwia. It is situated on the principal State highway, Warsaw–Poznan–Berlin, and has a total width of 10 m. and a clear span of 26 m. The arrangement is rather exceptional, as the footpaths are carried on brackets on the outsides of the two main girders.

The calculations for moving loads were made in compliance with the specifications of the Polish Ministry of Public Works, issued in 1925. These specifications provide that the roadway is to be

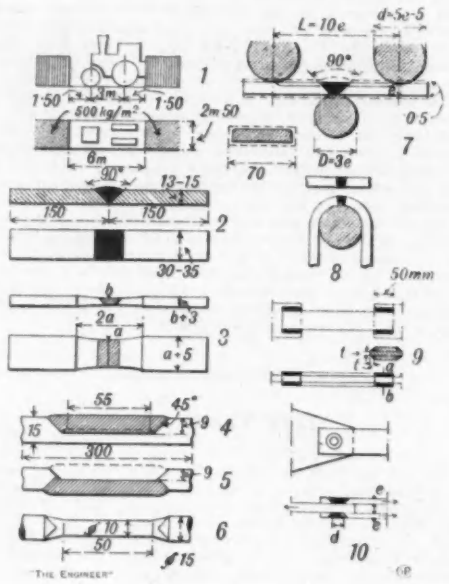


FIG. 1—TESTS

divided into longitudinal zones, each 2·50 m. broad, and each zone is to be loaded with a 20 tons (12 × 8) steam roller, 6 m. long—1, Fig. 1—with before and behind it a permanent load of 500 kilos. per square metre = 1·25 ton per metre length of a zone. To find the permissible live load on the total width of the roadway, the load of one zone is to be multiplied by the coefficient $\alpha = 0{\cdot}4\,b$ for the width of the roadway, when $b < 5{\cdot}00$ m. and $\alpha = 1 + 0{\cdot}2\,b$ for $b > 5{\cdot}00$ m. This means that the total live load of the roadway may grow proportionally to the width of the roadway until $b = 5{\cdot}00$ m. is reached; it then increases more slowly, for b greater than 5 m.

The cross beams were calculated as semi-rigid fixed beams, and the internal stresses were calculated with loads in the worst positions, and the compression members were calculated for buckling by the formula Tetmajer-Jasinski.

The material of the bridge is mild steel with an ultimate tensile strength of 3700–4200 kilos. per square centimetre, and a minimum elongation of 20 per cent.

SPECIFICATIONS FOR THE ARC WELDED CONSTRUCTION.

Specification for the arc welded construction was settled by the Polish Ministry of Public Works in April, 1928. It is the first official specification for welded steel structures in the world. The following provisions are made in it :—The electrodes are to be prepared from mild steel with an ultimate strength of 3700–4200 kilos. per square centimetre; it shall contain a minimum of 0·1 per cent. carbon and 0·25 per cent. manganese. They will be submitted to the following tests :—The specimens of mild steel are to be welded as shown in 2, Fig. 1, and the section is then to be reduced according to 3, Fig. 1. The ultimate tensile stress must equal at least 80 per cent. of the ultimate stress of the mild steel, *i.e.*, 0·8 × 3700 = 2960 kilos. per square centimetre—three tests.

For the elongation test the specimens are to be prepared from a steel plate in which a groove 9 mm. deep has been cut. In this groove welded metal is to be placed in successive layers—4, Fig. 1. Afterwards, the specimen is to be reversed, reduced by 9 mm.—5, Fig. 1—on the other side, and filled with the electrode again. The plate constituted in this manner is then to be divided into three pieces, from which three round test pieces, 10 mm. in diameter, are to be formed—6, Fig. 1—and on them the elongation is to be measured. The elongation shall be 18 per cent. at least—three tests.

Bending tests are to be carried out on flat plates, 120 × 70 × 15 mm., and are to be vee-welded in the middle—7, Fig. 1—and then be bent round a bar of a diameter equal to three times the thickness of the specimen—8, Fig. 1. No cracks shall appear when bending the specimen through 180 deg.—three tests.

For shearing tests the test pieces are to be made from two steel plates joined to gussets with welds 5 × 5 mm., 10 × 10 mm., 15 × 15 mm., and 5 cm. long—9, Fig. 1. The sections of the plates must be sufficient to resist the force S.

Width of the Weld.

mm.	kg.	kg./cm.
$t = 5$	S = 12,000	R s = 1000
$t = 10$	S = 20,000	R s = 1800
$t = 15$	S = 28,000	R s = 2400

The minimum resistances of the welds are R s —3 × 3 = 9 tests.

For shear tests in holes—10, Fig. 1—the test pieces must resist the force S depending on the thickness of the plate and on the diameter of the hole.

Thickness of steel plating.	Diameter of hole at the bottom.	S.	S s.
mm.	mm.	kg.	kg.
e = 8	d = 8	1000	750
e = 10	d = 10	1400	1100
e = 12	d = 12	2000	1600
e = 15	d = 14	3000	2500

S s is the minimum resistance of the welds in holes —2 × 4 = 8 tests.

The welds were calculated according to the author's formula :—

$K_s = (K_o - \mu\, t)\, t$ kilos. per square centimetre
$= (640 - 80\, t)\, t$ kilos. per square centimetre,

where t is the width of the weld.

CONSTRUCTION OF THE BRIDGE.

The main members of the bridge are parabolic girder trusses—Fig. 2. Their theoretical span h is 27·0 m., and the height in the middle h is 4·30 m., thus—

$$\frac{h}{l} = \frac{1}{6{\cdot}28}$$

All members of the trusses consist of plates, U beams, and angles—Figs. 3 and 4. The chords are double T-shaped, and consist exclusively of plates, the distance apart of the vertical plates being 300 mm., their height 370 mm., and their thickness 12 mm. The upper chord has one longitudinal plate, the lower one is composed of two plates of the dimensions shown in the drawings. Originally, the chords were designed with two and three plates, but they were replaced with chords of one and two plates to diminish the quantity of welding. The drawings show the principal features of the design.

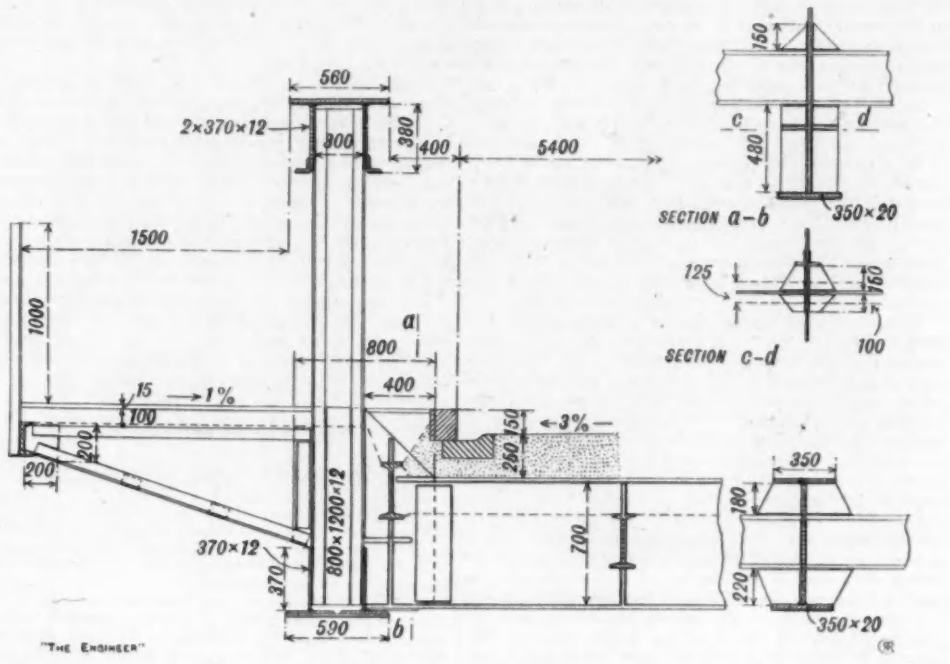


FIG. 3—PART CROSS SECTION

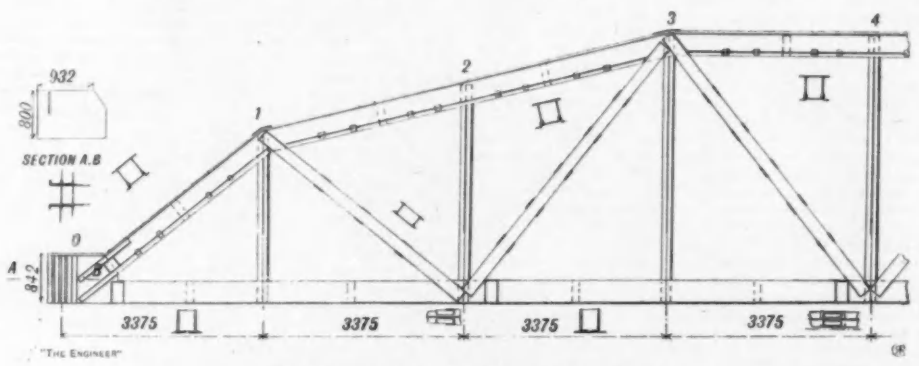


FIG. 2—MAIN GIRDER OF ARC-WELDED BRIDGE

I beams were used as longitudinal stringers, and were welded to the cross girders with the help of trapezoidals plates, not only for the purpose of fixing the stringers, but also to stiffen the web of the cross girder. This construction permitted the stringers to be calculated as continuous beams on elastic supports. The elasticity of supports diminishes to a great degree the advantage of continuity of beams, but it draws the cross beams into co-operation, and renders it possible to obtain a saving of 12 per cent. of the material of the cross beams.

All the plates are butt welded, but as in the calculation it was admitted that the butt weld has only 75 per cent. of the resistance of the constructional material, supplementary cover plates were added.

The wind bracing consists of angles, 70 × 70 × 7, welded to horizontal gussets joined to the lower chords of the main trusses, and of the cross beams.

THE ERECTION OF THE BRIDGE.

Pieces up to 7 m. long were welded in the shop. To prevent the separate parts from moving, special forms—15, Fig. 5—were arranged at intervals of about 1 m. The forms consisted of 20 mm. round bars bent to suit the cross sections of the welded piece. Gussets were welded to the interior of these bars and between them a gap of 5 cm. to 6 cm. was left. The opening was adjusted by means of two angles, so as to secure a width corresponding to the thickness of the vertical plates, *i.e.*, 12 mm. As horizontal locks, 50 mm. channel irons were employed. For the upper chord, which has a double T section, the channel stiffeners were placed between the vertical plates of the chord—16, Fig. 5. Between the gussets and the flange plates, a space of 25 mm. was left to permit the free access of the electrode.

The verticals are formed from a plate and four angles. All these parts were fixed by aid of two screws on both ends, and some short welds along each vertical. The two channel irons of the diagonals were fixed by means of two short channel irons, provisionally screwed to them. The exact distance of the channel irons was also assured by aid of plates with two suitable notches cut in them—17, Fig. 5. The cross girders were constructed by aid of forms similar to those employed for the chords—18, Fig. 5.

The available electric current at the field was about 180 ampères and 20 volts. Hand welding was used everywhere. Flux-covered electrodes "Tensil-end," manufactured by the Soudure Electrique Autogène, of Brussels, were used for the welding. The shop work was done in the bridge works of

K. Rudzki, in Minsk Mazowiecki, near Warsaw. The assembling on the site was executed on a temporary wooden trestle bridge. All the steel parts were brought to their proper place by aid of a wooden crane. The work began by building up the floor of the bridge and afterwards the main trusses were erected. Three welders were employed for the construction of the bridge. The work occupied 1100 hours-men in the shop and 900 in the field.

The floor of the bridge is of reinforced concrete.

The total weight of the bridge is 55 tons, as against 70 tons had it been riveted. The saving of

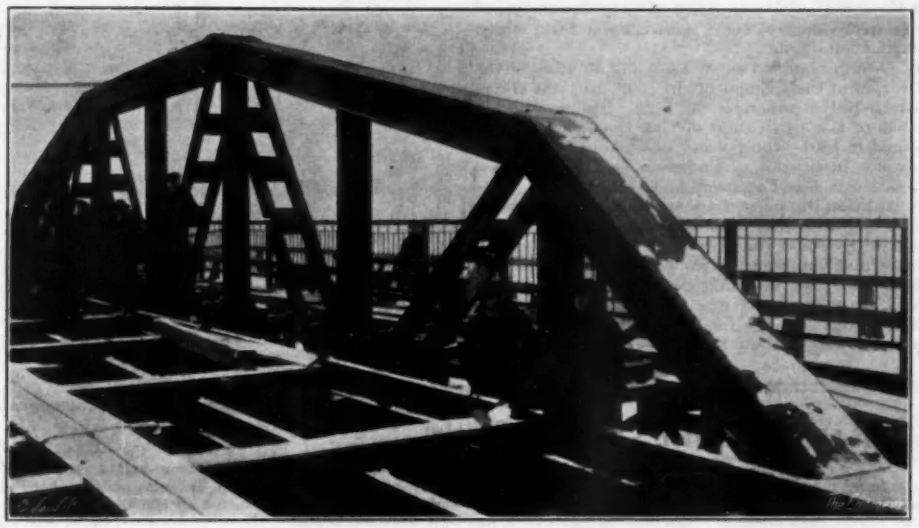


FIG. 4—BRIDGE DURING CONSTRUCTION

construction material was thus about 18 per cent. Unfortunately, an equal saving was not effected in the cost of the bridge, as a great part of the amortisation of the cost of necessary arc welding machines had to be included. Hence, the arc welded bridge cost almost as much as a riveted bridge would have cost. Nevertheless, the author is firmly convinced that with time the proportion of costs of the two types

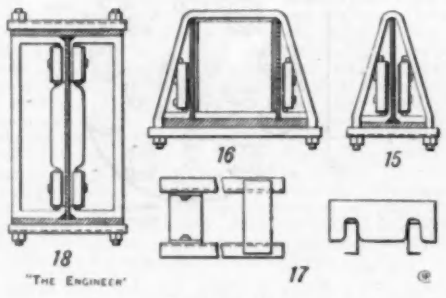


FIG. 5—FORMS

of bridges will be in favour of arc welded bridges. The courageous initiative of the Ministry of Public Works, and especially of Minister Moraczewski and Director of the Highways Department, Mr. Nestorowicz, who are the first Government Ministers to sanction arc welded structures, ought to be greatly appreciated.

The design of the bridge was made by the author, who also supervised the construction and erection.

The Boxer Indemnity and Railways.

By a British Engineer in China.

Now that the astute Ministers of the Nationalist Government have the ear of the Foreign Ministers of most European nations, there would seem to be some chance of the Boxer Indemnity Funds providing the Chinese nation with education, industry, and capital through railway expansion.

The Commission sent out in 1926 to settle the allocation of the British portion of this Indemnity decided for Education. This decision was largely influenced by the apparent tendency of the railways to become centres of disturbance. It may be admitted that the railways have concentrated disturbance and devastation and made for a fight to the finish. They quicken exhaustion in the combatants, for he who holds them keeps the arteries of life; his opponents become a minor disease of which time is the simple cure. Without railways the task of pacification of the whole country would have been impossible, and China would have drifted into another Taiping Rebellion of fourteen or more years' duration, whereas the only plague spots of unrest are now the inaccessible districts of Szechuen, Shansi and Kansu.

China may be at the dawn of a period of some years of quietude, and if she is, it will be found that there is no national asset so innately healthy as the railways. Within a week of the termination of military control in 1924, the Peking-Mukden Railway receipts went up to 2,000,000 dollars a month; and this average was maintained and even exceeded later. The release of the Shanghai-Nanking Railway to civil control after the late hostilities was followed by an almost immediate return to a paying basis.

To anyone familiar with the conditions of a district before it was tapped by a railway, the ultimate benefit of railways must be unquestioned. Take, for instance, the northern portion of Anhui Province before the Tsin-Pu Railway traversed it. This district had been devastated repeatedly during the Taiping Rebellion. It had never recovered, cities were ruinous and empty, inns were miserable, roads worse, and brigandage rife. Further, in a stretch of some 150 miles the following currencies were in use. The paper dollar of Nanking and the Mexican dollar held good for 30 miles, when it was replaced by a Portuguese silver dollar of 1793 for the next 70 miles, 1000-cash notes and copper coinage ran for a further 30 miles, and, beyond that, the ancient strings of cash was the only currency. Standards of length and capacity varied from village to village, and for the average villager the stinking medley of lanes which made a market town was the hub of the universe, the Mecca of immeasurable delights. The crowds which flocked to gaze at railway surveyors were an offence to eye and nose, parchment-pale with undernourishment, racked with tubercular coughs, afflicted with a Job's collection of sores. The physical decadence of isolation was only too apparent in the prevalence of harelip, general deformities, and a grade of mentality bordering on idiocy. The people were picturesque at a distance, because their patched garments had the mellowness of great age. They blended well with the anæmic colouring of their sparse crops, the produce of starved land for centuries unrested and overworked.

Flood overwhelmed the northern portion of this district in the summer of 1911. The villages became mere heaps of stinking slime, damp islands in the slurry of the fields where rotten crops lay bleaching. Draught animals were drowned in heaps, the seed-corn spoilt, the land too soured by inundation to yield an autumn crop. Famine gripped some hundreds of square miles in the late autumn. There had always been a hair's breadth between staving off the pangs of hunger and starvation. Grass and the bark of trees became the food of most, beancake the staple diet of the lucky few with money enough to buy it. Typhus followed as a natural consequence, and death was ever present, in work, in walks, about one's house. Thousands died, and as many more were saved solely because the new unfinished railway was able to provide a limited amount of transport to the Red Cross. If morbidly inclined, imagine the famine of 1922 in Shantung without rail connection to Manchuria, and recollect that 8 millions died in Chihli, Shantung, and Shansi in 1887 for lack of transport and roads worthy of the name.

On humanitarian grounds the case for railways is unquestionably strong. It is equally so on the economic score. Within a year of the establishment of through rail-connection on the railway in question, currency difficulties had disappeared. The line became an artery of trade. Most people have heard of Pengpu; to-day a flourishing town, in 1908 a string of hovels on a muddy lane—kennels for some 200 starvelings. Nanhsuchow and Hsuchowfu in pre-railway days were known only to students of the postal directory as dependent on couriers for letters, and for telegrams on a telegraph-line generally deeply engaged in the promulgation of a five-column edict from Peking. To-day they have electric light. Paved roads edged with solid houses link the city and the station, a brown scar in green fields when first the railway came. Remember also that these railway towns have doctors and hospitals of various grades. Relief of some sort is now within the reach of many who once were doomed by ignorance and isolation.

So much for the tendencies of railway expansion. Consider now the tendencies of Western education in China. Here we have a longer period for observation than in the case of railways. The first educational mission was that of Yung Wing, which left China for the United States in 1875. Very many of its members became prominent men of affairs, but they had to wait for many years before coming into their own. The Empress Dowager would have none of the New Learning; the Emperor's madness of 1898 had come too near success. Root and branch the Empress did her best to kill a poisonous growth, as she conceived it, and she was well served. The Yamens took their lead. The old style examinations were abolished in 1904, but it was not until 1906 that official examinations were renewed on modern lines, and then no successful candidates found employment. A few of the foreign-educated secured positions with the far-sighted officials who recognised the futility and danger of the policy of exclusion. Li Hung-Chang gave limited opportunities. Tang Shao-yi was a *protégé* of Yuan Shih-kai. Jeme Tien-yu, China's foremost engineer, came to the front under Yuan.

But these were the men not to be denied. The small fry who got a half-education in Japan were ignored, and formed the nucleus of the "China for the Chinese" and "Sovereign Rights" party, which created the pother over the Shanghai-Hangchow Railway loan in 1908. Then came the millenium of 1911, and the student had his chance at last. He failed, he merely talked and squeezed, whereas the old official squeezed, but now and then did something astonishingly tangible and wise. The student was the proverbial unproductive crystal egg.

Then the soldier took a hand in government and discovered his power after Yuan Shih-kai's death in 1916. The semi-educated malcontent has been on the increase ever since 1914, when the War set back the dawning era of industrial expansion. Such expansion really hinged on railways, and railway construction ceased then. The number of students increased every year, but capacity to employ these men did not increase with the largest industrial undertaking in the country merely marking time.

America had also largely increased facilities for foreign education by allocating a portion of her Boxer Indemnity to this purpose in 1908. The railways, telegraphs and other Government undertakings have done their best to absorb those with a claim on the Government, but these departments are so overstaffed that there is little for the men to do outside a dull routine. There is no chance of rapid promotion and no chance of acquiring experience, as there is no money for expansion. Thus even Government henchmen drift into teashop treason and minor plottings. For the ordinary student the creation of disturbance has become a profession, unless he has had the good sense to soil his hands with trade. There is no scope for education without employment, and the undertaking which gives greatest employment for the educated men for least capital is unquestionably that of the railways. To give further facilities for education without expenditure on the provision of employment would be merely to add to the present discontents and also to increase a permanently restless, unemployable, and very dangerous class, simply because it has the ear of the simplest and most gullible mob in the world.

The case for medical education is not a strong one. Doctors and hospitals are undoubtedly needed. But medical education, as Kipling's Lama remarked of all learning, "is of no earthly use unless of best sorts." The course is expensive in any case, and in China it is complicated by having to learn in a foreign language in most institutions.

A lengthy course is distasteful to the Chinese mind. The Chinaman always expects a quick return for his money. The student of medicine is, as often as not, content to leave the university unqualified, but with that dangerous half-knowledge which suffices for the modern doctor in the remoter cities.

What is true of medicine applies to other professions. The Chinese student has yet to find out that there is no Royal road to sound learning. Mental indigestion is the chronic disease of Young China of to-day. Mental exercise on practical problems, not Marxian or Anarchist theories, is the cure for this ailment, and until it can be provided, the use of the Boxer Indemnity for education can surely only be attractive to those with a firm belief in the maxim "Cast thy bread upon the waters and it shall return after many days."

That there is some case for the use of this money for railways will, perhaps, be conceded. The question of the best way of using the money needs a little consideration.

The British share of the Boxer Indemnity was in 1920 £11,180,000, or, say, 100 million dollars. This money, at 90,000 dollars per mile, would build, say, 1250 miles of railway—equipped with a 60 lb. rail—in easy country, or, taking the cost of the Lung-Hai Railway, which has been constructed spasmodically, but with comparatively little obstruction, at a cost of 120,000 dollars per mile, say, 830 miles. Of this

expenditure at least 30 per cent., or, say, 40,000 dollars per mile, should be for imported material, which would presumably, in this case, be of British origin. This would total for the whole of the 830 miles a sum of about 33,200,000 dollars, or £3,465,710 at the present rate of exchange.

The net revenue which would accrue to an extremely needy Government totals 9150 dollars per mile per annum, or a total of 7,600,000 dollars annually for the 830 miles. This is on the basis of the Government Returns of 1922; it is the average for the whole of the railways for a year of war and disturbance.

An efficiently managed railway in China will pay its operating expenses in a couple of years, and the line could not fail to be on a paying basis in three to four years at the outside, if the money were wisely spent on suitable projects.

In this last connection it is as well to mention that there are quite a number of abandoned railway projects in the country at the present time on which there has been considerable expenditure. The estimated amount of this expenditure is as in the table below :—

	Approximate expenditure. £
Hankow-Szechuen	1,000,000
Pukow-Sinyang	207,000
Nanking-Hunan	200,000
Ching-Yu Railway	1,085,000
Pin Hui	100,000
Peking-Suiyang	800,000
	£3,392,000

To these may be added the Canton-Hankow Railway, the enormous expenditure on which must remain of limited usefulness until through connection to Canton is made. There should undoubtedly be an effort to make these derelict investments productive.

It would, however, be infinitely better to keep this money permanently under a Sino-British Board of Control and allocate the yearly income as required, either for urgent railway expansion or for renewal of rolling stock, &c. Income at 6 per cent. from 100 million dollars is 6,000,000 dollars annually, which would suffice to build at the rate of, say, 50 to 60 miles a year. Thus gradually the mileage under what we will call the Boxer Indemnity Board would increase and China would have at last, to a limited extent certainly, a yearly construction programme which would ensure a greater rate of expansion than has obtained since the war. Thus also would be created a permanent construction staff of engineers, men who would have no chance of rusting under the influence of years of maintenance routine. There is no reason why such a Board would not work well. It has succeeded admirably in the case of the International Famine Relief Association. Members of the Board would be selected from officials of the Government Railways.

The money available for extension would also increase yearly, as it would, of course, be a *sine qua non* that all surplus revenues from Boxer-built lines should be allocated to new construction.

Obituary

THOMAS SYDNEY FLETCHER GIBSON.

IN our issue of last week we announced the death, at the age of fifty-nine, of Thomas Sydney Fletcher Gibson, M. Inst. C.E., the chief civil engineer of the South Metropolitan Gas Company, which occurred at his home in Blackheath, on August 28th.

Mr. Gibson was born at Long Sutton in March, 1870, and was educated at the City of London School. At the age of sixteen, he joined his father, Thomas Gibson, A.M. Inst. C.E., in his business at Westminster, under whom he took charge of and carried out several important contracts, among them the underpinning of Great Yarmouth Town Hall. He also superintended the fixing of a number of Gibson screw moorings at Rosstrevor, Greenhithe and elsewhere. He designed and erected Carpenter's-road Bridge over the river Lea at Stratford, the design for which was accepted by the late Sir Alexander Kennedy after open competition.

In 1895 Mr. Gibson took up a position in the drawing-office of the Vauxhall Works of the South Metropolitan Gas Company, where he was engaged for some time in the preparation of drawings for the modernising of Bankside gasworks. In 1900 he was appointed works superintendent at the Old Kent-road gasworks where, under the direction of Dr. Charles Carpenter, he carried out the reconstruction of retort houses designed to be operated with outside producers. He was responsible for the erection of the machine and fitters' shops, the design, erection and reorganisation of the stove and meter departments, and of general gasmaking plant.

In the early days of the war, it became necessary to erect special plant for the production of chemical products required for the maintenance of the textile and high-explosives industries of the country, and in 1916 Mr. Gibson was chosen to carry out this work.

At the end of the war he was appointed chief civil engineer of the South Metropolitan Gas Company. Since then a considerable amount of reconstruction had been undertaken, under Mr. Gibson's supervision, including the erection at East Greenwich of a reinforced concrete approach and viaduct, and a wharf wall of special construction with reinforced concrete walls and panelling. Large reinforced concrete coke bunkers have also been erected, having a capacity of 4200 tons of coke. One of Mr. Gibson's more recent undertakings was the conversion of Blackwall Point dry dock to a reservoir for the supply of water to the works. The reservoir is constructed of reinforced concrete, and has a number of decantation walls together with two large clean-water bays. The water is admitted to the reservoir through penstocks fixed at various tide levels on the face of a weighted dam. Among other structural work carried out under his supervision is the reconstruction of a gasholder at East Greenwich with a capacity of forty-five thousand therms (equivalent to eight million cubic feet) which is nearing completion.

Mr. Gibson qualified as an Associate Member of the Institution of Civil Engineers in 1899, and was transferred to full membership in 1922. He was also a Member of the Institution of Gas Engineers—which he joined in 1901—the Society of Chemical Industry, the Junior Institution of Engineers and the Southern Association of Gas Engineers and Managers.

In addition to possessing attributes which made him an engineer of exceptional ability, he possessed in high degree those qualities which fit a man to control others whilst winning their respect. He was straightforward and just, instilling confidence in those who worked with him, and was ever ready to promote their welfare. Though fond of outdoor life, he was, above all things, a home-loving man.

A Self-closing Boiler Stop Valve.

IN a Journal note published in our issue of July 26th, when recording the failure of a tube in the forward boiler of the Clyde high-pressure passenger steamer "King George V.," we referred to the fact that the immediate shutting of the self-closing valve in the main steam pipe prevented the steam from the other boiler from being discharged through the burst tube, thereby limiting to a large degree the seriousness of the accident. The fact that the turbines and the other boiler were immediately isolated from the forward boiler in which the accident took place, also ensured that the vessel was never without steam for any lengthy period of time, and that she could proceed homeward under her own power.

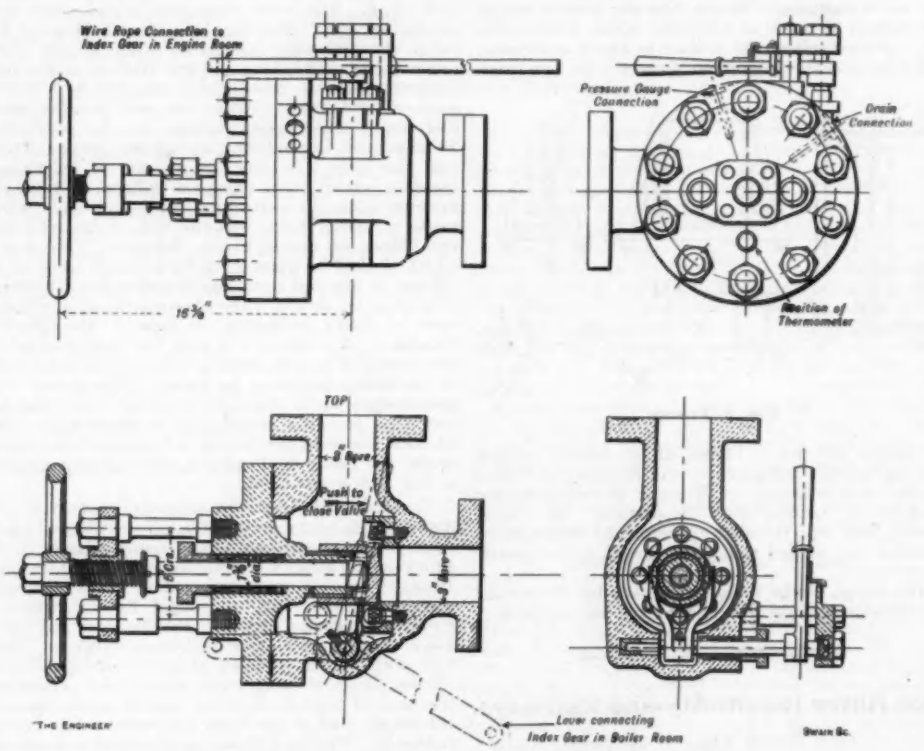


FIG. 1—HIGH PRESSURE SELF-CLOSING BOILER STOP VALVE

The forward boiler, which, it would appear, probably failed from shortage of water, was immediately taken in hand and re-tubed by its makers, and the steamer again entered her normal passenger service on the Clyde on Thursday, August 8th. The valve we referred to is shown herewith and is one of two 3in. main steam valves and two auxiliary valves designed by Cockburns, Ltd., of Cardonald, Glasgow, and built under the Cockburn and McNicol patents for Babcock and Wilcox, Ltd., the builders of the new 550 lb. pressure boilers in the "King George V." The valve design, herewith illustrated, has been specially sanctioned for use at sea by the Board of Trade, and it differs considerably from that described in THE ENGINEER of September 24th, 1926, which was the Admiralty type of self-closing valve as fitted with the original Yarrow boilers. Some account of the new valve, its application and its mode of operation may therefore be of interest to our readers.

From the sections given in the lower views of Fig. 1, it will be seen that the valve which closes down on to a renewable seat ring is controlled not only by the main hand wheel spindle, but by two forked arms, which are attached to an outside spindle moving in a stuffing-box. The arms engage the sides of the valve which is bored out to receive an internal guide piece fixed to an extension of the valve cover. When the hand wheel is turned so as to bring the screwed spindle to its top position, the valve itself is free to float in the flowing steam. It may, however, be closed against the steam pressure by simply pushing the handle shown in Fig. 1 or operating either of the index gear handles fixed in the boiler-room and the engine-room, and shown in the upper and lower views of Fig. 2 respectively. The design of the index gear parts

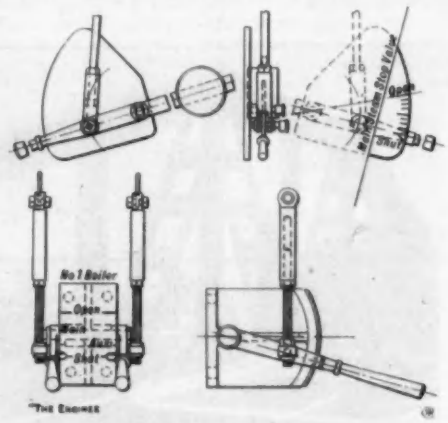


FIG. 2—BOILER AND ENGINE-ROOM CONTROLS

and levers is such that as long as the pressure at the outlet flange is maintained at about half a pound lower than that of the inlet pressure, the valve continues to float, and accommodates its position to the steam demand, so that designed pressure difference between outlet and inlet is maintained. At all times the valve is free to close as an ordinary internal non-return valve, and it can be closed by the main hand wheel. As soon as the flow from the boiler ceases, and the pressure at the outlet falls, the valve shuts down automatically and no back flow of steam from the other boilers through the steam main can take place. As soon, however, as pressure conditions are reinstated and the outflow pressure is about half a pound lower than the inlet, the valve automatically opens up.

The system, the makers claim, is one giving several useful operating features. As soon as the outflow from the boiler ceases, the valve closes down, and only opens again when the outlet pressure becomes a little less than the inlet pressure. The outside controls and the index gears in the boiler and engine-rooms, which we show in Fig. 2, enable the exact position of the valve to be seen at all times, and unequal steaming is quickly noted. The system is one which it is further claimed is particularly valuable on a range of boilers, for when standing by no boiler can deliver steam to the range until it is ready to do so, and the designed pressure conditions have been established at the valve. Again, such a valve ensures that if a boiler is not supplying steam to a range to which it is connected, it is not robbing other boilers of steam, and proportional steaming is more easily ensured. The recent accident on the "King George V." clearly demonstrated the advantages of the new valve in an emergency, and it would seem to be a useful fitting in the case of all high-pressure and high-temperature steam installations, in which any failure in the steam generating plant is likely to be attended with very serious results.

Railway and Road Matters.

THE circumstances under which a passenger train ran into some empty carriages at Hull on August 18th, were inquired into on the 29th of that month by Lieut.-Colonel Anderson. Apparently some defect in the track circuit allowed the upper arm of the arriving signal to indicate a clear road.

FROM figures published in the August *Railway Newsletter* it appears that in addition to spending £4,250,000 a year on materials for the repair and renewal of the permanent way and £14,500,000 on locomotives, carriages, and wagons, the four grouped companies buy 16,000,000 tons of coal, 17,000,000 cubic feet of timber, 21,000,000 bricks, 210,000 tons of rails, 9000 tons of paint, and 62,000 tons of oil.

THE electric railway originated by Mr. Magnus Volk at Brighton in 1883 is in danger of being swept away in projected improvements. It is of interest, therefore, to know that last year it carried over one million passengers, and that in the past six years the company has paid the Corporation £4600 in rent, £2545 in rates, and £1600 for electricity. Since the last lease was granted in 1921, £8000 have been spent on reconditioning the undertaking.

IN *The Times* of August 27th, Lord Shuttleworth, who was the chairman of the 1907 Royal Commission on Canals, published an interesting letter on that subject, in which he said: "Railway companies, though apt to depreciate canals as a means of transport, have felt some of the same alarm about their competition that they have recently evinced about improved roads. But on these they are now allowed to run their own motor vehicles. Why should they not be allowed, under suitable conditions, to run their own barges on improved canals? Thus, as traffic increases with reviving trade, they would relieve themselves of heavy loads that block their lines, yield less profit than other goods and passengers, and necessitate vast expenditure for sidings, &c., at terminal and other stations."

As showing the advantages, for both the companies and the men, that accrue from the sectional councils of representatives of both sides that were established under the Railways Act, 1921, we quote from the *Railway Review* the following agreement recently arrived at on the London, Midland and Scottish Railway: "If a driver or fireman passed for driving is not thoroughly acquainted with any portion of the line over which he has to run, he must obtain the services of a conductor. The conductor will be responsible for observing the signals, speed restrictions &c., and instructing the train driver. When the conductor is familiar with the type of engine employed, he must work the engine. In every case the train driver is expected to study the signals, speed restrictions, &c., for that part of the road over which he is being conducted."

DURING the six months which ended on March 31st, 1929, there occurred the strike of railway employees on the Rhodesian Railways, and interruptions due to washaways on the Beira lines. The figures showing earnings and expenditure for the half year clearly illustrate the result. The total railway earnings were £2,311,928, compared with £2,602,595 for the corresponding half year in 1928. Total gross operating expenditure was £1,447,059, compared with £1,478,202, and the net operating revenue £854,869, compared with £1,024,393, a drop of £159,524. Coal carried for the Union Miniere dropped from 164,798 tons to £141,756 tons, but coal for the Chemin de fer du Katanga rose from 37,495 tons to 51,380 tons. The copper for export traffic, suffered badly owing to the strike and washaways, the total carried during the six months ended March 31st, 1929, being 24,125 tons, compared with 49,673 tons for the corresponding period of 1928.

REFERENCE has been made in our last two Annual Articles on Railways to the new loops being built by the Southern Railway at Lewisham. To understand the purpose of those new connections, it should be known that the trains of the northern railways that join the Southern, *viâ* the Metropolitan Railway, have had to travel through London Bridge—which has been most inconvenient since electrification has brought a much greater density of passenger traffic through that terminus—in order to reach the exchange sidings at Hither Green. The new loops are, first, one from Nunhead, which uses part of the abandoned Nunhead–Greenwich line, across the main line and joining the Dartford line west of Lewisham Junction, and, secondly, one from the Addiscombe line, south of Lewisham Junction, to the Tonbridge main line north of Hither Green. These new connections have allowed the trains from and to the Metropolitan to travel through Elephant and Castle and Peckham Rye, and so avoid London Bridge. They have also given direct access from the West London Railway to Hither Green, and thereby improve the service with the Great Western, with the former London and North-Western, and the old North London, *viâ* Willesden. The new lines were brought into use on July 7th last.

THE collision on June 12th last in which, as recorded on page 675 of our issue of June 21st, a Sentinel-Cammell steam car was involved, occurred at Marshgate Junction, just north of Doncaster. The facts were inquired into by Lieut.-Colonel Anderson, whose report thereon was issued on August 22nd. The steam car was running from the Goole line, and as the signalman at Marshgate Junction had accepted a special passenger train from Leeds on the main line, the steam car was accepted under the "warning arrangement." Owing to the day being Sunday, the warning was given at Barnby Dun, over 4 miles away, and there were four intermediate signal-boxes closed with all their running signals at "clear." The first signal the man had against him was Marshgate Junction distant, but that was only 570 yards from its home signal. The driver overran the home signal, but makes no excuse for so doing, and the collision resulted. The driver of the special is also blamed in that he had ample warning to have pulled up, or, at least, to have minimised the effect of the collision. The use of the "warning arrangement" under such conditions is considered undesirable, and should be abandoned. As the distance from the home signal to the fouling point was only 45 yards, any system of automatic train control would have been ineffective.

Notes and Memoranda.

A PECULIARITY of the condensers installed in connection with the new 20,000 kW set at the Wealthy-street steam station of the Consumers Power Company, Michigan, is that the tubes are expanded into the tube plates at both ends. It is explained in *Heat Engineering* that this practice is becoming more important (in America) as the boiler pressures rise. With high-boiler pressures even minute amounts of condenser leakage will cause trouble.

THE detailed figures for the month of June indicate the magnitude of the waste of natural gas in Western America. Every day during that month 641,883,000 cubic feet of natural gas from California oil-fields blew off into the air. This is equivalent to the heat, or energy, value o 1121,100 barrels of fuel oil, or 34,600 tons of coal per day. For the whole month of June the loss of gas amounted to 19,256,500,000 cubic feet, equal to 3,633,300 barrels of fuel oil, or 1,038,000 tons of coal.

A "BOILER" explosion recently reported from the Isle of Wight is tragic on account of the loss of a life through a very elementary oversight. The "boiler" was used for cooking pig feed and was supplied with steam from a boiler working at about 80 lb. per square inch. It was fitted with a relief valve which opened freely at 30 lb. per square inch. When, however, the pressure rose above this amount the valve opened to such an extent that a nut on its stem, used to compress the spring, closed the steam outlet from the inside, and naturally remained there with any increase in pressure. The pressure did increase in the cooker, and it exploded with fatal results to the attendant.

IN welding monel metal, states the *Iron Trade Review*, a few simple precautions must be observed. First, a neutral flame should be used. The tip should be larger than that required for steel of the same thickness. Cold-drawn monel metal wire or strips cut from sheet should be used as the welding rod. The oxide film which forms on the surface helps to protect the metal underneath from further oxidation. Keeping the outer envelope of the flame spread over the weld area will also aid in excluding air. The rod should be melted under this skin of oxide and slag. Any particles of dirt or foreign matter should be worked up into the slag by melting underneath them. Then, when the weld is built up well above the surface, as all welds of this metal should be, grinding will remove all oxide, slag and impurities.

IN a paper presented at a meeting of the American Institute of Electrical Engineers, Mr. Robert W. Wieseman stated that hydrogen is an excellent cooling medium for high-speed rotating electrical machinery. When it is substituted for air, a machine can be operated at a higher load with the same temperature rise, and the windage loss is reduced to one-eleventh. Furthermore, since no oxidation can take place, the life of the insulation is increased, and short circuit and corona troubles are very materially reduced. The machine is especially quiet, and it can be placed out of doors without increased expense. The first commercial application of hydrogen cooling to electrical machinery was made with a 12,500-kVA outdoor synchronous condenser, and another, rated at 20,000 kVA, is also in operation. Both of them were brought into service in 1928. The results obtained to date have been very encouraging, and three more machines, rated at 15,000 kVA, are under construction. Not only have the hydrogen features of the machines performed satisfactorily, but during the past winter the machines operated successfully out of doors without protection from the weather.

AFTER continuous operation without a break in service since August, 1927, the 12-mile, 132-kV underground cable that connects the Hell Gate generating station of the United Electric Light and Power Company, New York, to the Dunwoodie distributing station of the Yonkers Electric Light and Power Company is being duplicated by the laying of a second cable line of the same voltage. Installation started recently, and the work is expected to be completed in September. The new cable, which is to give the Greater New York companies added facilities for serving the Westchester area, contains a number of refinements or improvements resulting from operating experience with the older cable. That cable, which at one step doubled the operating voltage for underground transmission, and which, with its hollow core filled with oil under pressure, was a new invention, was shipped from the factory with the oil drained off. It required refilling with oil after installation, which was a long process requiring great care. The new cable lengths are shipped from the Schenectady plant of the General Electric Company with the core filled with oil supplied by temporary reservoirs mounted inside the cable reels. The jointing is done under oil pressure with the temporary reservoirs connected to the opposite ends, and is accomplished with very little loss of oil.

ACCORDING to a contemporary, there are 52,000 miles of railway track on the railway systems of Great Britain, the upkeep of which costs over £12,000,000 per annum. This track consists of the rails, the cast iron chairs and the sleepers. Prior to the war it was generally agreed that for British railway requirements sleepers cut from Baltic redwood fir, which was easily obtainable at a reasonable price, were the most satisfactory. Since the war, however, the cost of timber has increased, and close attention has been given by railway engineers to the question of adopting sleepers made from materials which can be produced in this country. As some 4,000,000 are used annually, sleepers of British steel would materially assist the iron and steel industry, which has been severely depressed in recent years. The steel sleeper has always been considered more costly than the wooden sleeper, but new designs have been produced which bring the price down to nearly the same level. In view of this, and with the desire to help the British steel industry, the railway companies are experimenting extensively with the use of steel sleepers. Tests conducted by the Great Western Railway as to the comparative costs for a track mile of steel and timber sleepers showed that first costs, on a basis of 2000 sleepers to the mile, gave a difference of £26 in favour of timber; but the scrap value showed a difference of £131 a mile in favour of steel, and there was also a difference in the net cost of renewal of £105 in favour of steel.

Miscellanea.

IT is proposed to erect some ratproof godowns at Ootacamund, at a cost of 50,000 rupees.

THE scheme for the improvement of the port facilities at Hulutao, Manchuria, will involve the expenditure of about £3,000,000, and will be spread over a period of three years.

TWO new schemes for hydro-electric development have just been sanctioned in America. They are for 79,000 horse-power on the South Platte River in Denver and for 26,820 horse-power on the Nisqually River, Washington.

IMPORTS of calcium carbide into this country during the second quarter of this year amounted to 10,544 tons. Norway was the main individual supplier with 3251 tons, whilst Sweden sent 1029 tons, France 1276 tons, and other countries 4987 tons.

THE production of raw steel in the Saar Basin is reported to have reached record figures in July, the output amounting to 198,422 tons, as against 190,803 tons in the preceding month. The productive capacity of the blast-furnaces is estimated at 6370 tons in twenty-four hours.

IT has been decided by the Chinese Government that a Council should be appointed to reorganise the affairs of the China Merchants Steam Navigation Company and the Han-Yeh-Ping Iron and Coal Company. These two concerns are among the most important on the river Yangtze.

A PROGRAMME has been formulated for the complete survey of China, and it is suggested by the National Government that the work will be completed within three years. The scheme will require the training of a large staff of surveyors and the provision of a great amount of instruments.

A NEW bridge is being built across the Ohio River at McKees Rocks, near Pittsburg, at a cost of 7,000,000 dollars. It will have a main arch span of 800ft., four spans of about 350ft. each, and several minor spans. The total length will be about a mile. The roadway is to be 40ft. wide, with two 6ft. sidewalks.

A LARGE deposit of coal in the north-eastern part of Kirin, Northern China, Province has been discovered. According to a report made by engineers sent there for the purpose, the extent of the productive area is 19 square miles, with an estimated total output of 30,000,000 tons of coal. A number of private commercial interests are organising a company to develop the area with a franchise from the provincial authorities.

THE whole line of the Kin-Han Railway, is facing bankruptcy, declares Mr. C. S. Liu, director of the Peking–Hankow Railway Administration. There are only twenty-seven locomotives, ninety-seven passenger cars, and 573 freight trucks, along the Peking–Shunteh section of the line. Owing to military transportation, most of the freight cars have been commandeered by the authorities, while many of the engines and passenger cars are in bad condition, with the result that no rolling stock is available for traffic purposes.

THE new reinforced concrete bridge over the river Wainganga at Bhandara in the Central Provinces of India, has been opened. The bridge is, says *Indian Engineering*, of particular interest because it spans one of the most formidable obstacles to all-weather traffic on the Great Eastern Road. The road is one of the main arterial communications of the Central Provinces, and is calculated to gain more in importance when it is the through route between Bombay and Calcutta. The bridge is 1600ft. long and has eighteen spans of 80ft.

FAILURE of the timbering of the Moffat Tunnel, Western America, at a point about 3000ft. from the east portal on July 26th resulted, according to the *Engineering News-Record*, in the blocking of the track by about 400 cubic yards of material, and forced the Denver and Salt Lake Railroad to divert trains over the 23-mile track over the continental divide used before the completion of the tunnel. The first failure occurred about 5 a.m., and was followed by other falls at 9 a.m. and at noon. It is stated that the roof timbers had been weakened by dry rot.

IT is reported that a new coalfield has been discovered in Northern Rhodesia. It lies west of the Kafue River, within easy distance of the Konsonso Mine, and roughly about 190 miles west of Broken Hill. If the coal is of good quality it may seriously affect the Wankie Colliery. This colliery at present supplies the Union Minière with over 300,000 tons of coal and coke per annum, and the Chemin de Fer du Katanga with about 110,000 tons of coal per annum. The distance from Wankie Colliery to Union Minière and the coal depôts of the Katanga Railway is 733 miles, while from Kafue the distance is only 400 miles.

IT is reported in the *Chemical Trade Journal* that a large deposit of celestine (strontium sulphate ore) has been discovered on the river Pinega, near Archangel. The deposits are estimated to contain about 3·2 million tons of the ore. The mineral is in an easily workable condition and is accompanied by strontianite (strontium carbonate). Analysis of a large number of samples has revealed the percentage composition as strontium sulphate 89·8, strontium carbonate 3·8, silica 4·16, iron oxide 0·17, alumina 0·42, and calcium carbonate 0·68. The material is thus of quite as high a quality as the German deposits in the principality of Waldeck, which latter are now practically worked out.

THE Aberdeen and Commonwealth Line, which some time ago took over the 14,000-ton ships of the Australian Commonwealth Line from the Government, has embarked on an extensive policy of bringing the ships more up to the requirements of a trade in which the company has been engaged for nearly a century. The "Moreton Bay," which recently sailed from Southampton, is the first of the five to rejoin the service. Two others, the "Jervis Bay" and the "Esperance Bay," are at Newcastle and London respectively, undergoing alteration, and the "Hobsons Bay" and "the Largs Bay" will be dealt with as soon as they complete their present voyages. In some respects the passenger accommodation of the "Moreton Bay," which had 686 passengers when she sailed for Brisbane, has been entirely reconstructed.

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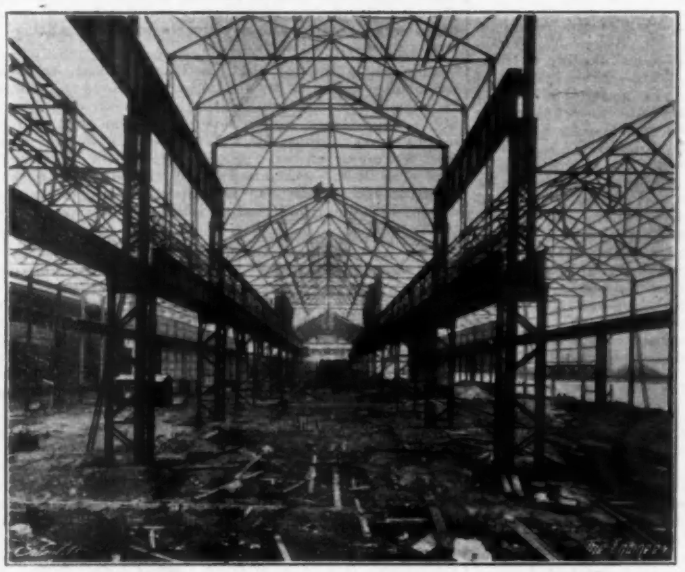

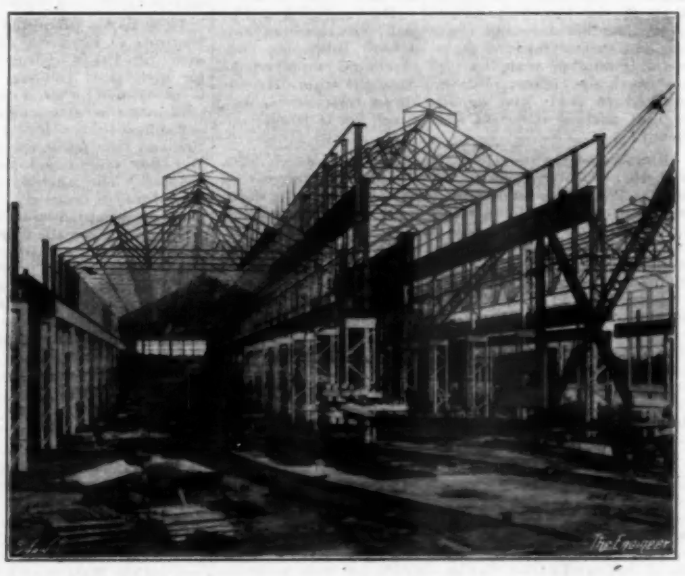

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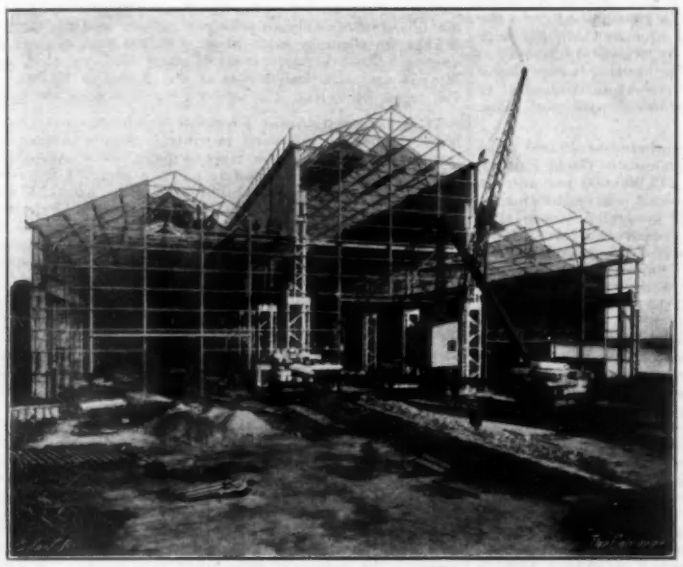

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THE ENGINEER.

SEPTEMBER 6, 1929.

Modern Steam Pressures and Temperatures.

THE wish expressed some time ago by Mr. H. L. Guy that power station engineers could be made to agree on a limited number of standard steam pressures and temperatures shows as yet little sign of being realised. At no previous period, indeed, has there been so great a difference of opinion or divergency of practice with regard to steam conditions in central stations. One can say with truth that pressures and temperatures are both rising, but to what general level they are likely to attain or, indeed, what level is now sanctioned by good practice, are questions which cannot be answered. The advance made during the last few years, particularly as regards pressure, is so irregular that it partakes more of the nature of isolated leaps than of any steady gain of ground. Boiler pressures in imporfant power stations of recent construction range from 375 lb. to 1400 lb. per square inch. It is difficult to think that so great a variation is, even mainly, due to the divergence in the circumstances of different plants. It seems, rather, to be a reflection of the differences of opinion which are found among engineers, according to whether a caution that is almost timidity, or a courage which some would call recklessness, predominates in their attitude towards new developments. With steam temperatures, the range of variation is naturally less than with pressures, yet within this range a similar diversity of practice is to be found. The lower limit of temperature in any modern plant may be put at 700 deg. Fah. Until recently the upper limit was 842 deg. Fah., the figure adopted by Mr. Herry at Langerbrugge over four years ago, which constituted at the time by far the highest steam temperature in any central station in the world. It is, however, now equalled by the Issy-les-Moulineaux station at Paris, and will be exceeded in the new Battersea station of the London Power Company, for which Dr. Pearce has had the courage to decide upon the use of steam as hot as 875 deg. Fah. This latter temperature is practically the same as that in use at the Mannheim station, where the steam leaves the superheaters at 1400 lb. gauge pressure and 878 deg. Fah. temperature, a combination of extreme conditions which is certainly unparalleled. The full temperature and pressure, it may be remarked, are not put on the turbines, for the steam is first passed through an inter-stage reheater, where it reheats the exhaust from the high-pressure turbine and has its own temperature and pressure reduced to 806 deg. Fah. and 1310 lb. respectively. The cycle appears to be a very promising one, and likely to be about as efficient as any cycle which is attainable without asking too much from available constructional materials.

A very brief consideration of modern developments with regard to pressure and temperature is sufficient to show how curiously boldness in one direction is often associated with caution in the other. In America, for example, there are now at least half a dozen plants working with steam at 1400 lb. per square inch, but none, so far as we are aware, is using a steam temperature of more than 750 deg. Fah., even if that figure is reached. The latest 1400 lb. boilers put down at the Edgar station of the Edison Illuminating Company at Boston are designed to deliver steam at 725 deg. Fah. only. We have in England no 1400 lb. plants as yet, the highest pressure contemplated in any central station being the 1100 lb. selected by Mr. Thomas Roles for compounding his Bradford plant. Although the pressure does not equal that of some of the new American stations, the temperature at Bradford will be considerably higher, namely, 800 deg. Fah. At Billingham it is higher yet, 850 deg. Fah., but the pressure is only 750 lb. At Battersea the temperature of 875 deg. Fah. is to be associated with a pressure no higher than 600 lb. It would be possible to deduce from these figures that engineers were of the opinion that greater efficiency might be safely sought, either by increasing pressures or increasing temperatures, but that there was some reason for not attempting to do both at the same time. In accordance with such a view, the tendency of American engineers to adopt high pressures with moderate temperatures, might be contrasted with the apparent preference in Europe to keep pressures down and temperatures up. Creep tests lead to the belief that there is a limiting correlation between pressures and temperatures when available materials are employed. Yet at Mannheim, where the superheaters work at 1400 lb. and 878 deg. Fah. simultaneously, the association of a very high pressure with an exceptionally high temperature has not been feared. In contrast with this, it may be mentioned that at the great Klingenberg station which was opened last year to supply Berlin, the designers chose a temperature as low as 770 deg. Fah., although the steam pressure was only 500 lb. per square inch. Even greater moderation was shown in connection with the design of the East River station, opened less than three years ago at New York. This plant, which will have an ultimate capacity of no less than 1,000,000 kW, and is to serve as a base-load station, has a steam pressure of not more than 375 lb. per square inch and a temperature of only 700 deg. Fah. Economy of operation is, of course, of first importance in a base-load plant, and those who might wonder whether a high economy is compatible with the steam conditions at East River, might reflect on the performances of the Padiham station in Lancashire. There, as our readers will remember, the steam pressure is only 250 lb., with a temperature of 620 deg. Fah., yet the plant is the most efficient in the whole country when the correct basis of comparison is made, namely, the number of units of heat expended per kilowatt-hour actually delivered to the feeders, instead of per kilowatt-hour generated. Enough has been said to justify our remarks as to the difference of opinion amongst engineers as to what are the optimum steam conditions for a large power station. American practice, at present, does not favour high temperatures, and it was only last year that Mr. Moultrop, the chief engineer of the Edgar station, stated publicly that "station designers in the United States seem to feel that 750 deg. Fah. is about the limit at this time," and that "those who have gone beyond this limit have not given due consideration to the characteristics of the materials when maintained at high temperatures over long periods." European designers are likely to dissent strongly from the latter view, claiming, we think with justice, that knowledge as to the manufacture and the characteristics of special steels is distinctly more advanced on this side of the Atlantic. Even if this claim be questioned, it matters little, for European engineers can point to the long-continued use of steam temperatures a hundred degrees higher than the American limit without the employment of anything but good ordinary mild steel. The Langer-

brugge superheaters, we believe, are of this material, with a carbon content of about 0·08 per cent., and the fact that they have withstood their arduous working conditions in a perfectly satisfactory manner suggests the thought that the development of special materials is perhaps less essential to progress at the moment than the development of courage on the part of users. At Mannheim, where temperature and pressure are both exceptionally high, nickel steel is used for the tubes and chrome nickel steel for the headers of the superheaters.

Time will amost certainly bring about a convergence of European and American ideas, higher temperatures being adopted on the other side of the Atlantic and higher pressures being more general on this. Neither there nor here is there likely to be any retreat from the technical positions won, for theory indicates and practice confirms that the greater the pressure and the higher the temperature, the greater can be the economy of operation. The comparative success of certain exceptionally well-designed and managed low-pressure plant is no answer to the advocates of better steam conditions. There is no valid reason why a high-pressure plant should not be as well designed and operated as a low-pressure one, and when this is done the inherent advantages of the higher pressure must make themselves evident. To quote Mr. Moultrop again: "A high-pressure station will operate just as satisfactorily as a low-pressure station, and will pay a handsome dividend on the money and effort expended"; and he has further stated that the thermal efficiency obtained at Edgar was a "substantial improvement" on that possible with a 350 lb. station, while the cost of high-pressure plant was not necessarily more. The opinion of engineers who have pioneered with regard to temperatures is similar, and, what is more to the point, the Edgar and Langerbrugge plants have both been considerably extended at the high pressures and temperatures originally adopted tentatively. There has, moreover, never yet been, so far as we are aware, any serious accident to men or machinery at the pioneer plants, nor has any engineer who has adopted any advance in steam conditions ever reverted to more conservative practice. The future of steam is bound up with higher pressures and temperatures than are now usual, and it is to be hoped that the enterprise shown by engineers like Mr. Roles and Dr. Pearce will be emulated by others, so that British manufacturers and users alike may be able to show achievements at least comparable with any abroad. To lead in new developments is to gain prestige and the trade that follows from it; to wait for others is to admit inferiority and to court commercial decline.

Family Allowances for Workmen.

THE stability of an industry depends upon two factors: first, those employed in it must be able to earn a decent and reasonably comfortable livelihood; and secondly, the product of their labour must be saleable at a price which will permit an adequate return on the capital invested. To arrange matters so as to give effect to both these requirements is the whole art of management. Both of them turn directly or indirectly on the question of wages. Now there are many theories of wages, ranging from the severely logical one that each man should be paid in exact accordance with his productivity, to the more practical one that the greatest contentment of all, compatible with a permissible wages bill for a given output, is the ideal to be aimed at. The advantages and disadvantages of piecework, premium bonus and day-work systems of payment have been so often discussed that there is little more to be said about them. But the one point underlying the success of them all, namely, that the worker should be content, and that, to be content he must not suffer too severely from the *res angusta domi*, is worth more than a thoughtless acquiescence. There may be incontrovertible logic in the argument that if Smith does exactly the same quantity and quality of work as Brown, both should receive the same remuneration. The statement has a precision about it which is dear to the mind of an accountant. It seems so obviously true that there could be no room for any difference of opinion. Yet looked at from another point of view, it does not appear to embody the same elementary justice as at the first glance. Smith and Brown are not merely productive units in a factory. They are also members of a civilised society, which lays upon them and enforces certain legal and social obligations. One may have family duties, children to feed and clothe, and dependent relatives to provide for. The other may be a bachelor with no one to spend money on but himself. Clearly the wages which would bring comfort and satisfaction in one case might be hopelessly inadequate in the other. The family man, who, after all, is the best citizen, may have to live in a state of relative, if not absolute, poverty, in the endeavour to perform his moral and legal obligations. This is not conducive to social or industrial contentment.

Industry has, to a certain extent, adjusted itself to the conditions by the payment of a wage supposed to meet the needs of the "average family" in so far as the earnings of the industry will permit. But the doctrine of the "average family," with its fractional number of persons, is more satisfactory to the statistician than to the man with a lot of little children to bring up. The income tax authorities, whom no one would accuse of being sentimental, ease the burden of their imposts on the family man, regardless of the logic which would insist that all citizens having equal protection from the State should contribute equally to its funds. The feeling that industry should give some analogous assistance to wage earners has gained a good deal of ground on the Continent, with a disregard, in this case, of the generally logical aphorism that equal pay should be given for equal work. The idea was first given an organised form, we believe, in a number of quarries in the Tournai district shortly before the war, and the system, under the name of "*allocations familiales*," has since entered largely into Belgian and French industrial life. The primary object was to ease the hardships of men with family responsibilities without the increase in the cost of production which would have been involved in a general rise of wages. Nominal wage rates, whether piecework or daywork, were therefore left unchanged, but men with children under working age were given a monthly bonus proportional to the size of their family. The payment of this bonus was an entirely gratuitous act on the part of the employers, who made it dependent upon a reasonable standard of time-keeping and conduct. It is obvious that no firm could afford to take such a step alone, for it would be handicapped in its costs of production as compared with its competitors. Equally obviously it would not do for different firms to work the scheme independently, even though all paid the same bonus rates, as otherwise men with large families might find difficulty in getting employment, and firms with a large percentage of such men would be under a financial disadvantage. To make the scheme practicable all the important firms in each industry organised themselves according to districts, agreed on the conditions of the bonus for each industry and district, and subscribed to a common fund in proportion to the number of their employees. From this fund the bonuses were paid. Agreement was all the easier because the only alternative possible was a general rise of wages to a level sufficient to enable the most heavily burdened workmen to live. But even so, credit must be given for a voluntary act, certainly instigated in large measure by a sense of social justice. So important has the system of "*allocations familiales*" become in Belgium that it has recently been regularised by legislation, and now no Government or municipal contract for more than a few shillings may be awarded except to a firm conforming to the system. Organised as it is, the scheme of "*allocations familiales*" has none of the taint of patronage or charity, so repugnant to the pride of a respectable workman. The recipient takes his family allowance with no more sense of shame than the income tax payer claims his corresponding benefit. There are no "strings to it;" he is as much entitled to it at one firm as at another, so that his liberty of seeking more congenial employment is not restricted. Nor does the system interfere in any way with the natural rise and fall of wages. It is superimposed on ordinary wage rates and is not necessarily dependent on them. Its effect, regarded in the broadest manner, would seem to be to share the total wage fund available for a given class of labour in such a way as to tend to secure a more equal standard of comfort for all the employees. To that extent it should make for peace in industry. Whether it is applicable to all countries and to all conditions of employment we do not propose to discuss. It has certainly taken firm root in Belgium, where it no doubt enables a lower average wage to be paid without hardship to individuals. But Belgium is a country notable for the control of industries of all kinds by great banks and trusts, which can decide on and enforce a unity of policy very difficult to attain where independence and competition are the rule. Those who direct the industrial life of the country are the very reverse of socialistic in politics; yet, as is often the case, they have shown that an enlightened individualism is capable of producing and carrying out schemes of far-reaching social significance. The extra francs paid per month to a man with a family may be a small thing in themselves, but their payment involves a principle which affects the whole system of wages. It is an admission of the fact that justice may not be completely done by payment by results any more than it can be by a uniform wage for all alike. The equal wage system makes the strong bear part of the burden of the weak, and incidentally compels the efficient to earn part of the wages of the inefficient. By setting apart a family allowance fund from the sum available for general wages the industry is making the men with no family charges contribute indirectly to the wages of those who have. The strong, again, in a sense, are made to help the weak, but with this difference, that the ineffective or idle workman is not thereby put on a level with the efficient one.

The family allowance system is the outcome of an appreciation by industry of what has long been recognised by the State, namely, that a man with children or dependents at his charge is fulfilling a duty which may with justice be alleviated. It is legitimate to wonder whether, had the principle been accepted earlier in history, and carried out more fully, the results would not have been better than the policy of providing so much for the mental and physical needs of school children at the expense of the ratepayers. However this may be, it is unquestionable that any system which recognises the responsibility of a parent and assists him to carry it out is a useful element in the social fabric. The results of the system in Belgium, where it has well passed the experimental stage, should be studied by all those interested in industrial questions. More than 800,000 workmen now have the benefit of it, and there is a demand for its extension to industries not yet covered. The *Usine Belge* recently quoted, apparently with approval, the views of Monsieur Carton de Wiart that such extension was highly desirable. The opinion was expressed that the interdependence of industrial prosperity and the improvement of the conditions of labour were bringing about a gradual conception of the workman and his family as the industrial unit, rather than the workman alone. This conception, in the concluding words of the article, "Apparaît comme la réforme sociale la plus importante et la plus heureuse que nous ayons connue depuis la guerre."

Technical Education from a Students' Point of View.

No. I.

THE subject of Technical Education is thorny. Even the middle-aged engineer of well-proved ability, even the professor whose wisdom is acknowledged in every civilised corner of the earth, even the President of the Institution of Mechanical Engineers himself must tread delicately on this ground. The graduate admiring the letters after his name, feeling light-hearted and merry—though a little weary after his pre-examination labours—may consider the system of training perfect; but his opinion carries little weight. The undergraduate, having failed, finding himself faced with the labour of repeating the ardors, burning again the midnight oil, and sitting on a very hard bench to listen to a dull but most important lecture, may declare that the educational system is "rotten." He is disregarded.

But perhaps all these eminent people may pay some little attention to a young man now nearing the completion of his "time" in the "works," who has both failed and succeeded in examinations; who has experienced the training of a great technical college, and—subsequently, not before—of a secondary establishment.

There is fairly general agreement that the present training of the mechanical engineer is much too long. Even though the prospective engineer leaves school at an early age, it is unlikely that he will earn his own living before he is twenty-three or twenty-four. But many stay at school until they have reached a more normal leaving age. Out of twenty pupils under indentures to the firm with whom the author is serving his "time," there is one approaching the thirties, and two more than half-way through the twenties. The average age of the pupil who completes his time is about twenty-four. The majority have

celebrated their "coming of age" before entering the "works."

The training of the engineer is divided into two parts—college and the works. There is, and there always will be, a mild controversy as to the best way of "fitting" the two parts together. The majority of engineers have been to college first and the works afterwards; but many colleges are run in conjunction with the works—turn and turn about. Many people consider that the works training should come first. The arguments for and against each system are well known, and no arrangement appears to have any decided advantage over the others. The student usually spends three or four years at college and three years in the works. Might not the college training be cut down profitably to two years? Very few of the engineers at the head of the profession to-day spent more time than that at college; and few will be willing to admit that the rising generation are any the better engineers on account of the extra year at college. The author heard quite the opposite stated; but age frequently takes that view of youth!

How many parents realise how much it will cost them to make their sons engineers? Leaving out the cost of schooling, which is common to all professions, it is certain that the parents will have to pay out a sum not less than £1000 from the time at which the boy leaves school until the time at which the man proudly declares himself independent. If the student lives at home while studying at the college, he is likely to cost £150 a year; if he has to live in lodgings, another £50 may be added fairly. When he leaves college and goes to the works, he naturally demands a larger allowance—he is living in a little society of his own; he is a member of various works clubs, by which, as is the way of such clubs, he is regarded as a "rich" man; he is expected to contribute to all the activities of these clubs. Although, among his own class, the different "incomes" are well known, he naturally wishes to stand as high as possible. He desires, at least, to own a motor bicycle. He wishes to come home occasionally for week-ends, to visit exhibitions and attend the meetings of the institutions. Many firms demand premiums before they will take pupils. The parent who manages to keep down expenses to £200 a year will be lucky. If we take the average yearly cost over six years as £175, the total cost of education is £1050. And what has the parent gained for his son by this expenditure?

The young engineer has obtained a degree; but some figures published recently in THE ENGINEER show how little this is worth. He has learnt, and no doubt forgotten, a very great deal of theory. A large amount of this he has found to be of very little practical value, and he is beginning to think that 90 per cent. of engineering jobs depend on practice and experience and that out of the remaining 10 per cent. of jobs which require theory, four-fifths lie in the province of design in which he is probably interested more from the practical point of view than the theoretical. About the small residue of required theoretical knowledge he finds that his ideas are a little hazy. At college it was so much overborne by the necessity of "getting on" to other things more important for the examinations.

In the works he has, if he is an engineer, gained a good groundwork for the knowledge that more experience only can give him. But, when he gets his job, he is still a little surprised to discover that he gets comparatively good pay, not because he is a B.Sc., but because he can state that he has had three years' practical experience, and he finds that many of the men of equal standing with himself have not got a degree. Yet at the end of all his training he can consider himself very lucky if his salary is £250 a year, rising to £350.

Can this be called a fair return to the parent for his expense of time and money? If he is not himself an engineer, the college training will have seemed to have been more important than the "works." His son begins to feel doubtful of the great value put upon the college training and desires more practical experience. Something seems to be wrong with the college training. Many young men enter the colleges with the idea that at the end of three years and the passage of several examinations they will be turned out real engineers with a thorough training. It is needless to state that they are the sons of anyone but engineers. It is a bitter discovery to them that, having perhaps obtained an "Honours" degree, all that they can then earn for several years is a mere pittance. The college training has been expensive, and they regarded it as the beginning and the end of their training. Sometimes they can afford to pay no more for education and, rather than take a mere pittance learning practice, they turn towards the more immediate rewards of teaching; they become demonstrators and hope in time for junior professorships. Others find avenues of escape in Government jobs in which theory is of more value than practice, as is the case in various research departments. Surely there is something wrong with a system of training that brings neither immediate rewards in the direct current for which it sets out to train the young man nor an increase of value after the practical stage is passed.

It will be seen by now that the author's quarrel with the present system of training lies with that part of it provided by the technical colleges. So far as the "works" side of it is concerned, he is perfectly content. But before going on to consider what the technical colleges ought to teach, the character of the people most concerned must be considered.

There are, quite definitely, two types of student in most technical colleges. One is the product of the public school; the other has proved his capacity in a secondary school or has gained an engineering scholarship. The first goes to college to learn engineering; the degree is a secondary object, which he only desires because he believes that it opens the door to opportunity. The second goes to college with the object of "cramming" for the degree. Both are mistaken; one as to the value of the training he will receive the other as to the value of the degree. From the first the secondary school man settles down to be crammed; unlike the public school man, he already knows half the syllabus required; his knowledge needs brushing up only.

The public school man, on the other hand, finds himself for the first time in his life free from restraint. It is just as well, perhaps, that at first he does not realise how free. He is still at heart a boy; he still feels that to work harder than is absolutely necessary is a crime, and in consequence he is likely to pay but little attention to a lecture which is dully presented. Unless his interest is challenged by the lecturer he is far more likely to carry on with his neighbour a *sotto voce* discussion of England's Rugby prospects in the coming season or the exact reason why his motor-bike fails to go faster than 50 miles per hour. Unlike his fellow-students from the secondary schools, he finds when exercise time comes round that, whether he has attended to the lecture or not, he knows very little about the problems set before him. This being the case, he will probably continue the discussion so ably begun in the lecture room. In fact, it comes to this: that, unless he is forced in spite of himself to be interested, he will do very little work until the first-year examinations loom close ahead.

Not only do the two types of student differ as to the amount of knowledge which they bring to the college. Throughout his life, so far, the public school man has done his best to do as little work as possible consistent with passing a few examinations. To him the others seem almost wickedly studious; in consequence he is not at all averse to "picking" their brains, and his conscience will not trouble him unduly if he copies down a whole calculation from the other's exercise book without bothering to find out what it means; he will earn marks that way. He has always considered that "masters" have had an unfair advantage over him; he now finds that he can get a little "of his own" back by "ragging" the lecturer. This idea is not encouraged by the secondary school men, who appear to think of professors with some awe as beings of superior intelligence. It would seem at first that the two types could not be educated together; but there is a considerable amount of "give and take" on each side, and a good professor has a wonderful knack of controlling the exuberance of the more naturally buoyant members of his audience. Thus those who wish to work can and those who do not are constrained to carry on their amusements in a less public and more silent manner.

It will be seen that the most successful professor is he who can interest the public school man. At present there are very few men with the ability to do this, even when dealing with a naturally interesting study. And yet it should not be so difficult; the public school man has an antipathy to learning, but he is easily interested, and he is reaching an age at which a desire for knowledge is growing upon him, although he does not admit it directly; he is secretly rather ashamed of his ignorance.

(To be continued.)

Railway Accidents.

ON August 27th the Ministry of Transport issued its report Cmd. 3379 on the accidents of last year. It has been compiled for the first time by Lieut.-Colonel Mount, who, in May last, succeeded Sir John Pringle as Chief Inspecting Officer. It follows exactly the lines of its immediate predecessors, but we note one improvement, which is the reproduction of the main features of the first table in the Accident Returns—usually issued in May and upon which the annual report is based—which gives under nine headings the number of train accidents and of failures of rolling stock and permanent way for the last six years.

It is public knowledge that the last two years, 1927 and 1928, were exceedingly bad years as regards railway accidents; in fact, they were the worst two consecutive years since 1873–1874. That, however, is only the case if we measure railway safety by the number of passengers killed in train accidents. Last year, as Colonel Mount observes in the present report, "elements of chance, in the circumstances attending some of the accidents," were "particularly adverse." Forty-eight passengers were killed last year, but out of that unusually large number forty-one met their death in two collisions—Darlington and Charfield—whilst of the twenty-seven killed in 1927 all but two were killed in the accidents at Hull and Sevenoaks. It is only natural that the public should measure the safety of railway travel by the number of passengers killed; but, as we have on many occasions shown, it is rather the number of accidents than the results of the accidents that should be the test. For that reason the inclusion of the table mentioned above is to be commended, as it shows that, despite the exceedingly bad record in fatalities, the number of collisions, derailments, failures of engines, failures of couplings and of broken rails was less than in any of the preceding five years in the table; the only increases were 56 failures of tires, which compared with an average of 53 for the previous five years; and 69 failures of axles, which exceeded only the 68 of 1925 and the 65 of 1926. On the other hand, our perfections in this matter make our blemishes all the more pronounced. It is unpleasant to read, for example, that the Darlington collision "illustrates the desirability of improvement in the method of verifying a driver's knowledge of the general principles of signalling, and of the positions and functions of signals in large installations where he may be called upon to carry out shunting work," and that "attention was also drawn to the incorrect use of the term 'calling-on' arm as applicable to an ordinary shunt-signal movement." The Charfield accident pointed to "the desirability for expedition and the pursuance of a more progressive policy, so far as it is practicable, in regard to the elimination of gas from existing stock." Whilst only one of the six accidents in which passengers lost their lives was a derailment, that and two other derailments, following those of the preceding year—obviously Bearsted and Sevenoaks—"again illustrate the punishing effect which heavy tank engines have upon track material and the reaction of this type of locomotive to irregularities in line and level, particularly at high speed. Though the accident at Chatburn was primarily attributed to failure of an inherently weak spring, in none of these cases was the road of sufficiently high class to justify the conditions imposed."

It is a satisfaction to know that, though thirteen collisions were inquired into during the year, automatic train control would have prevented only four of them. It is added, on that subject, that the report of the Automatic Train Control Committee is expected shortly—we believe that the Chairman's draft report is now in the hands of the members. It is also gratifying, in view of the activities of the International Labour Office at Geneva as to automatic couplings, to find that only six servants were killed when coupling or uncoupling vehicles; one of these men was engaged in adjusting an automatic coupling. Another direction that has given considerable concern is the large number of fatalities to permanent way men and others engaged in work on the track. A serious aspect of that class of accident is the comparatively frequent fatal results. In 1927, of 105 cases, 52 were fatal, and in 1928, out of 130 accidents, 63 were fatal. There was thus an increase in 1928 over 1927 of 25 accidents and of the increase 11 were fatal. It is regrettable to find that the headings under which there was an increase in the deaths are "Failure of permanent way men to act upon warning received or to comply with regulations," and "Want of individual care in crossing lines, &c., or lack of care on the part of others." As Colonel Mount observes, "Education in this respect appears to be the only practical solution. Few protective measures other than the encouragement of personal care and insistence upon strict regard to the safety regulations laid down, with the advocacy of safety propaganda, can be suggested to ensure a reduction."

BOOKS RECEIVED.

Rivista Marittima (Luglio, Agosto), 1929. Rome: Ministero della Marina.

Journal of the Institute of Transport. No. 9. Volume 10. London: The Institute of Transport, 15, Savoy-street, W.C. 2. Price £1 1s. net.

The Gas Air-lift Pocket Book. By R. Stirling, M. Inst. C.E., &c. London: E. and F. N. Spon, Ltd., 57, Haymarket, S.W. 1. Price 5s. net.

Journal of the Franklin Institute, August, 1929. Philadelphia, Pa.: The Franklin Institute of the State of Pennsylvania, 15, South Seventh-street, U.S.A. Price 60 cents.

Financial, Industrial and Commercial Conditions in Canada. Report by F. W. Field. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 3s. net.

Air Photography. Part I.: Organisation and Training. Air Publication No. 1354. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 1s. 3d. net.

The Pressure Produced on Blowing Electric Fuse Links and Striking Electric Arcs in Closed Vessels. By G. Allsop. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 1s. net.

Note on the Construction of the Godavery Bridge, Kazipet-Belharshah Railway. By R. V. Gregory. Calcutta: Government of India Central Publication Branch, 3, Government-place, West. Price 5s. net.

Bearing Bronzes With and Without Zinc. By H. J. French and E. M. Staples; being Research Paper No. 68 of the Bureau of Standards of the United States Department of Commerce. Washington: The Government Printing Office. Price 15 cents.

Home Office Report on Conferences between Employers, Operatives, and Inspectors Concerning Fencing of Machinery, Prevention of Accidents, First-aid, and Temperature in Cotton Spinning Mills. By Eliot F. May. Published by H.M. Stationery Office. 1929. Price 3d. net.

Some Hydrautomat Developments.

In all parts of the world where continuous irrigation for intensive cultivation is employed the question of water-logging has been found to be serious. In the Punjab, for instance, this problem is at present very acute, since a million acres or more of good land are affected, and in many cases villages and towns have been destroyed or are threatened with destruction. The trouble is especially noticeable in the vicinity of the large main irrigation canals, and the whole question is receiving the most serious consideration of the Irrigation Department. Various remedies have already been suggested or applied. Open draining canals—sometimes in conjunction with porous drains—

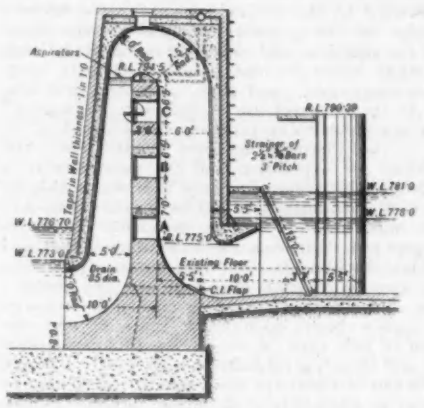


FIG. 1—SYPHONIC RAREFIER

have been cut; deep tube wells have been sunk, and pumping has been carried out by electric power or oil engines. Such pumping is, of course, effective, but it is expensive.

Lately, however, three Hydrautomat installations, which make use of the power in low falls existing at the main regulators in the canals, have been successfully put to work for this purpose on the Upper Chenab Canal. We described the original example of the hydraulic-pneumatic system known as the Hydrautomat when we illustrated and gave particulars in our issues of June 16th and July 7th, 1922, of a demonstration plant which we had had the opportunity of inspecting in operation at Carshalton. Although, admittedly, the technical efficiency of the type of Hydrautomat now being used in India, which operates on a system which is entirely different from that of the apparatus which we described in 1922, is not very high, the designers, Hydrautomat, Ltd., of Victoria

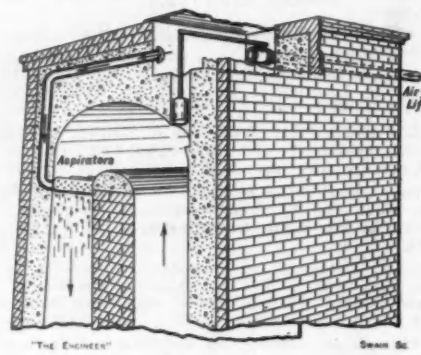


FIG. 2—ASPIRATOR GOVERNOR

Station House, London, S.W. 1, point out that their simplicity of construction and operation makes the plants particularly suitable for pumping water within reasonable distances of falls, while the commercial efficiency—that is to say, the output of the plant compared with the initial outlay and the operating expenses, the latter being practically nil—is high.

In the cases to which we are about to refer the problem was to raise drainage water brought up to the lower level of the canal and to deliver it into the canal some hundreds of feet, horizontally, from the fall from which the operating energy is derived, the lift varying with the state of the drain and the canal level at the time, up to a maximum value of 8ft. The energy necessary to raise the water is generated at the fall itself by the use of what may be termed a syphon rarefier, which is so arranged as to be capable of inspiring a continuous stream of air at a vacuum amounting to about half atmospheric pressure. This source of potential energy is connected by means of a pipe line to the point at which the actual pumping has to be done, and there actuates a kind of inverted air-lift pump which effects the lift. Each pumping installation, therefore, comprises, essentially, two parts: a rarefier and a lifter.

As the various parts of the three pumping plants, referred to above, only differ in dimensions and details, it will only be necessary to describe one of them. In Fig. 1 are given drawings of the rarefier at Bambanwalla. It will be seen that it comprises a syphonic arrangement embodying a chamber formed by a reinforced concrete casing made impervious to air, in which the upcast and downcast limbs of the syphon are constituted by a vertical wall of concrete stretching from end to end of the chamber. The arrangement is such that the lower ends of the upcast and downcast limbs are always water sealed. In the height of the division wall there are openings A, B, and C, which form communicating passages between the upcast and downcast limbs of the syphon. These passages may be opened or closed by means of butterfly valves, which can be manipulated from outside the casing. It will be noticed that the lowest of these openings is below the lowest level to which the water in the upper portion of the canal is allowed to fall.

In putting the rarefier to work, the butterfly valve in the lowermost passage A is opened and water is allowed to pass through it from the upcast to the downcast limb of the syphon. The water passing through, in splashing down on to the surface of the water in the downcast limb, entraps a certain amount of air. The area of the passages is so arranged that the water passing through will acquire a velocity of at least 6in. per second in the full area of the downcast shaft, and it has been found that that velocity is sufficient to carry away to the outside atmosphere a certain proportion of the bubbles of entrained air. The result is that, since the whole syphon is a closed air-tight case, the level of the water rises in both limbs. The rise continues; but becomes slower when the outlet from the lowest passage becomes drowned by rising water in the the downcast shaft, the production of air bubbles then, obviously, becoming reduced. By that time, however, water has begun to flow through the next higher passage B, and so the process continues until the whole syphon is filled with water, and vigorous flow over the top of the wall begins. The valves in the priming passages are then closed. The dividing wall, it may be explained, is some 8ft. 6in. long, and we understand that the time taken to make the device act as a pure syphon is about ten minutes.

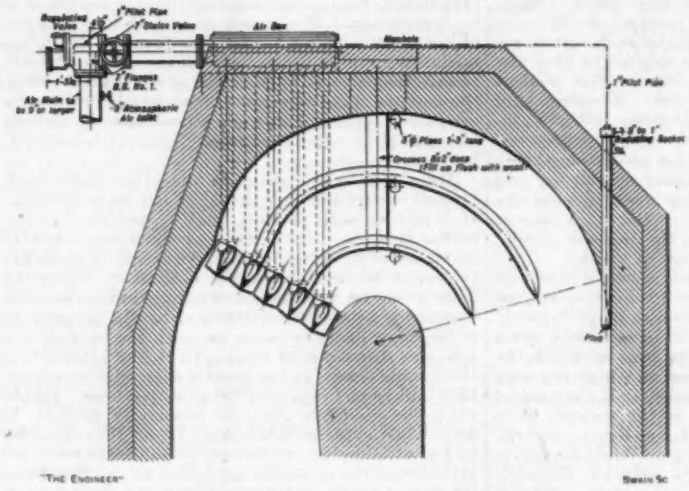


FIG. 3—ARRANGEMENT OF ASPIRATORS

Now, the flow of water through the syphon has the effect of entraining air if a pipe be connected to the top of the syphon.

Contrary to the commonly accepted idea that the least air leak will cause a syphon to become unprimed, it has actually been found that a steady stream of air may be allowed to enter the system, the only effect being that the velocity of flow of the water is reduced. This condition of affairs, however, only obtains if the proportions of the various parts are carefully attended to. The chief points requiring attention are:—(*a*) The position and type of aspirators through which the air actually enters the water; (*b*) the degree of contraction of area of the channel at that point; (*c*) the velocity set up in the downcast passage; and (*d*) the shape and size of the crown of the syphon. If no air be admitted, the discharge through the syphon is, of course, only reduced by the friction and velocity losses, which, however, are much greater than might be at first supposed, on account of the changes of direction that must take place between inlet and outlet, which changes must, for constructional reasons, be in the nature of very short radius bends. Nevertheless, we understand that, in the case under consideration, a fall of 5ft. produces an average velocity in the downcast limb of 11ft. per second. On

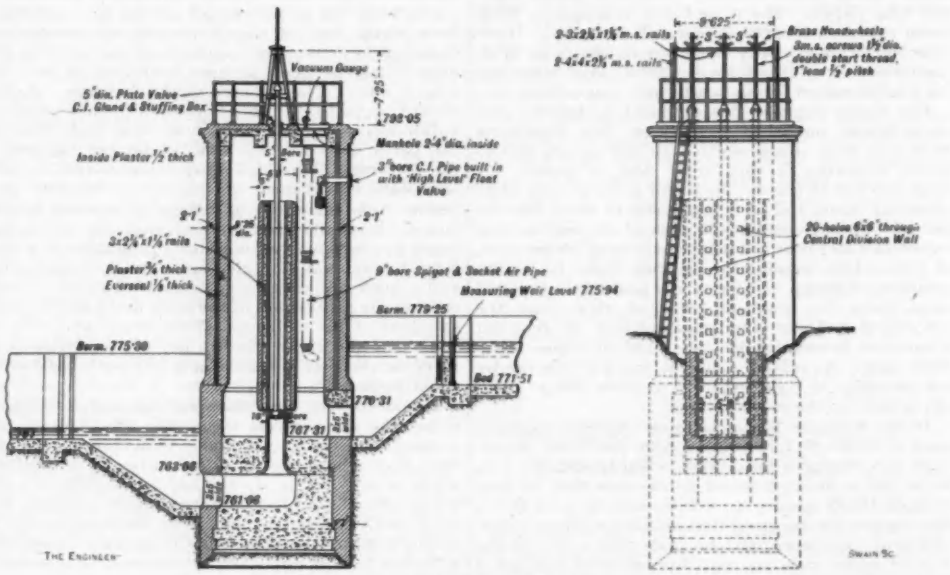


FIG. 4—HYDRAUTOMAT LIFTER

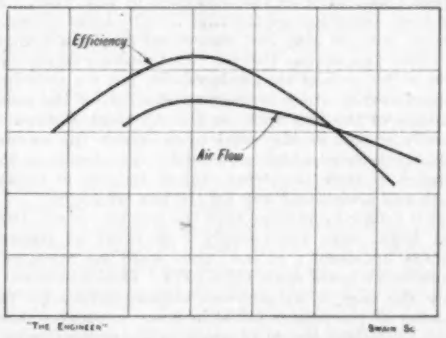


FIG. 5—EFFICIENCY OF SYPHON RAREFIER

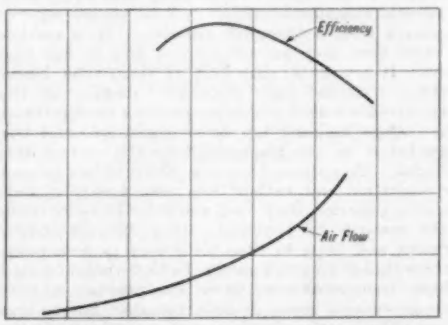


FIG. 6—EFFICIENCY OF VACUUM AIR LIFT

admitting air, the speed is reduced to an extent depending upon the amount of air admitted, and a point is eventually reached when any further admission of air is liable to cause failure of the syphon. At that point, so we gather, the flow velocity has fallen to nearly half the original speed. Inasmuch as the quantity of water flowing is then least

while the quantity of air entrained is greatest, the efficiency rises to a maximum under these conditions, and it is important that the syphon should be capable of operating as near as possible to the failure point, though there must, of course, be no chance of its reaching it.

For this reason the aspirators for testing are always connected to the air main by an automatic governor valve which only allows air to pass freely provided that the water is running through the syphon at a safe speed. That object is attained by employing a valve, the opening of which is automatically controlled by the Venturi depression at the position of the aspirators as compared with, say, a point in the upstream limb level with the aspirators. For example, the valve will be allowed to remain full open as long as the degree of vacuum existing round about the aspirators is 5ft. greater than that which exists in the

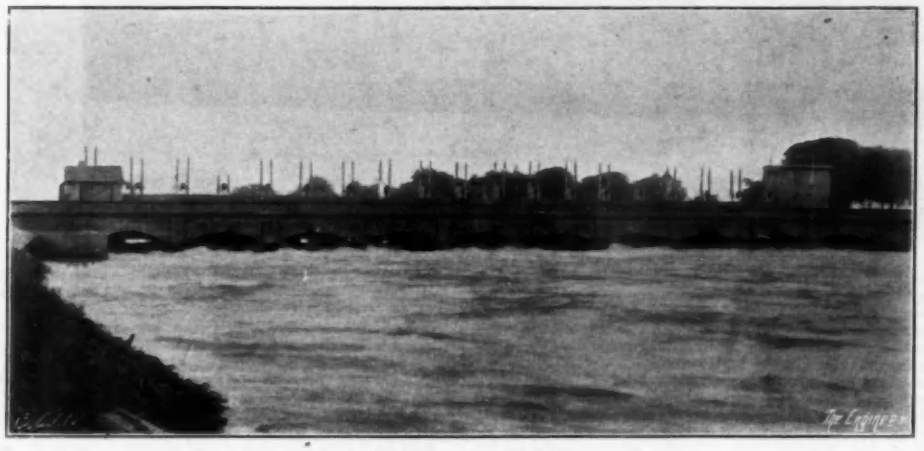


FIG. 7—MAIN REGULATOR AT BAMBANWALA

upcast shaft. On the other hand, should the velocity of flow fall, so as to reduce that 5ft. extra vacuum to only 3ft., then the valve will be entirely closed so that no air can enter the system. If, therefore, there is any danger of failure taking place, it is at once removed, and the water will flow faster through the syphon.

A simple mechanism for fulfilling this condition is shown diagrammatically in Fig. 2. It embodies, as will be observed, a float-operated balanced valve in the air main running to the lifter. In the case of the Bambanwala it is a 6in. valve. At the top of the downcast limb of the rarefier syphon the air main terminates in a series of specially designed aspirators, and in passing through these aspirators the flow of water entrains the air and creates the partial vacuum. If rather too much air is being drawn through the pipe so that the flow velocity becomes

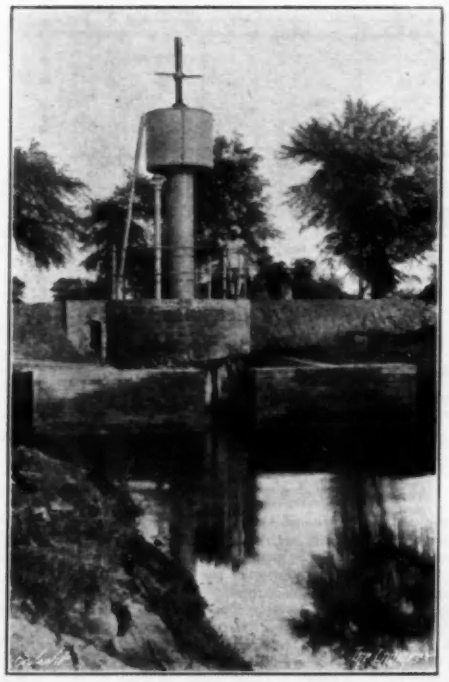


FIG. 8—LIFTER BUILT OF STEEL

so high that there is a danger of the syphon becoming unprimed, the water level in the upcast limb tends to fall, with the result that the float also falls and closes the valve to a greater or less extent, and shuts off the admission of air, either partially or, if necessary, entirely.

The aspirators are arranged in the throat of the syphon as shown in Fig. 3. They are of cast iron, are hollow, and have a fish-like section. They are perforated with holes through which air is sucked from inside them into the water as it flows past them. The individual aspirators are joined together by pipes communicating with a collector box from which the main pipe goes to the lifter.

We will now proceed to explain the action of the lifting portion of the installation.

The "Lifter" at Bambanwala is illustrated in Fig. 4. It consists of a concrete chamber constructed so as to be proof against air leakage, and of sufficient strength to withstand an internal vacuum of about half atmospheric value. Arranged within it are vertical tubes, the lower ends of which communicate with the channel from which the water has to be raised. Running down the centre of each tube is a small pipe, which is suspended from and passes through the roof of the chamber, and which is furnished at its lower extremity with a hollow casting which is perforated with holes so as to form a rose. This pipe is open at its upper end, is fitted with a valve, and when the latter is opened the interior of the chamber is put into communication with the atmosphere through the rose and pipe. The pipe with its rose is capable of being moved up or down in the tube, for a reason which will be explained later, and for that purpose it is provided with a screw and hand wheel at the top outside the chamber. To prevent air leakage the pipe passes through a stuffing-box arranged in the roof.

The interior of the chamber is connected to the rarefier by means of the pipe line mentioned above, this pipe line actually terminating in the chamber just below the roof. When the rarefier is operating and communication between it and the lifter is effected by opening a valve in the pipe line, a partial vacuum is formed in the chamber of the latter, with the result that water is drawn up into it from the upper or discharge canal. The arrangements and vacuum are such that the water level reaches, approximately, the level of the tops of the tubes which are in communication with the lower canal. Simultaneously, the partial vacuum causes the water to be sucked up the tubes from this lower canal, until they also become partly filled with water. If, now, the air pipe and its rose be raised by means of the hand wheel and screw until the rose is some 18in. above the standing water level in the lower canal, atmospheric air will, when the valve is opened, enter the pipe and issue through the holes in the rose, because some degree of vacuum exists in the water at the level of the rose—if we may so express it—since it is above the downstream level and consequently forms a hanging column. The bubbles of air rise up through the water—which has already been sucked up to nearly the top of the tube—reduce the specific gravity of that water, and cause it to rise and flow over the top of the tube, and thence into the upper canal. This process is continuous as long as the vacuum set up by the rarefier is sufficient to remove all the air which enters the chamber, so that a continuous flow of water between the lower and upper canal is started and maintained.

The apparatus is analogous to the common form of air lift pump, though, in it, the flow rises up in the air pipe and returns freed from air downwards, whereas in the orthodox air lift pump the water flows downwards, as it were, to start with, enters the lift tube deep down, and then rises together with the air. The same laws, however, which apply to the ordinary air lift pump also apply to this Hydrautomat apparatus.

In an air lift pump the matter of submergence is the first consideration. Such a pump is, in essence, a U tube with legs of unequal length, the solid water column in the well, which lies between the water surface and the foot-piece, approximately balancing the column of air-water mixture in the tube between the foot-piece and the delivery level. The quotient of the former by the latter is a fraction which, roughly, indicates the specific gravity of the air-water mixture, and experience has shown that this fraction should, in general, be about 0·7 for good results. Although the value may be as low as 0·4, it is found that the higher it is the better, the reason apparently being that a mixture composed of much air in relation to water is inclined to flow in a highly turbulent fashion, the water tending to fall back and allow the air to blow through it. In the vacuum air lift pump it is the water level elevation within the tower or tube above the delivery level, and the same level above the intake level, which correspond to the two columns of the balanced U tube, and it is found that the submergence proposed, as indicated above, accords with the experience of air-lift pump operation.

After allowing for the friction loss in the pipe line, a vacuum corresponding to a head of about 16ft. is, we understand, maintained in the lifting chamber—in the case under consideration—and the apparatus will work satisfactorily up to a lift of 8ft. We gather, however, that it is quite flexible, and that the quantity lifted, when the lift is small, is, up to a point, increased in direct proportion. A vacuum of 24ft. can, we are informed, be maintained without difficulty by means of an Hydrautomat rarefier, and water can be raised in one lift up to 12ft. If a greater lift than that be called for, there is no difficulty in arranging two or more lifters in series. They may either be at the same place or, if circumstances make it more desirable, they may be some distance apart. As an example of a case in which the latter arrangement would suit local conditions well, Hydrautomat, Ltd., cites a drain being pumped into a canal which is somewhat high relatively to the natural surface. It is pointed out that a deep drain close to the canal bank might be there avoided by placing the initial lifting stage some hundreds of feet away.

As it is convenient to sectionalise the actual lifting conduit, the lifter may be operated over a wide range of output. In the lifter at Bambanwala there are, as will be seen, three lifting tubes or channels, and it is stated that an output variation of 1 to 6 can be obtained without serious sacrifice of efficiency. In this connection we are enabled to reproduce in Figs. 5 and 6 typical efficiency curves from a syphon rarefier and a vacuum air lift, respectively, which have been supplied to us by the designers.

Hydrautomat, Ltd., points out that the apparatus described in the foregoing can be conveniently employed in all cases in which the lift does not exceed, say, 30ft.; that it is inexpensive to install, since it lends itself—in all but very small sizes—to easy construction in common building materials, iron and other metal parts being almost eliminated; that there is no limit to the magnitude of the plant and hence to the volume of water lifted; and that the place at which pumping or lifting takes place may be at a considerable distance from the energy-producing fall. One rarefier can deal with any fall up to about 10ft. If the fall is greater than that, part will have to be wasted or rarefiers would have to be built in series or cascade.

We are enabled to reproduce in Figs. 7, 8 and 9 three half-tone engravings showing the plant at Bambanwala. The first of these represents the main regulator. On the left-hand side may be seen a building which contains the first rarefier, which was put to work in 1927. It energises the lifter shown in Fig. 8, which was built entirely of steel, a material now abandoned. The output of this plant is

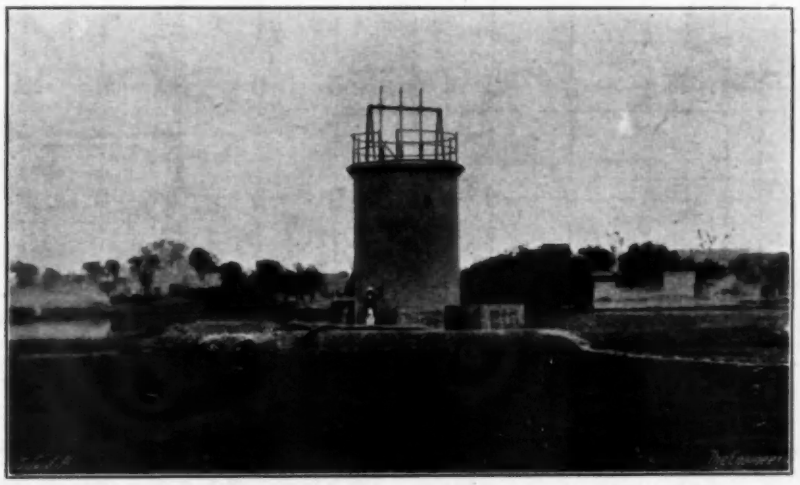


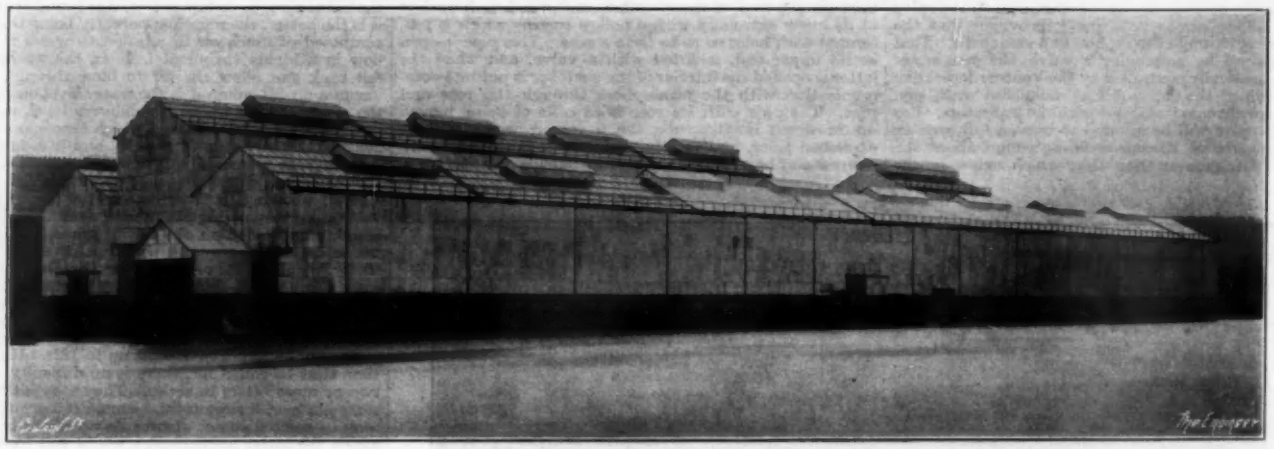
FIG. 9—LIFTER BUILT OF MASONRY AND CONCRETE

about 5 cubic feet per second and the lift varies from 5ft. to 8ft. On the right-hand side of Fig. 7 is seen another building, which contains a second and larger rarefier, which operates the lifter shown in Fig. 9, which is of masonry and concrete. The latter installation has a capacity of 10 cubic feet per second against the same lifts. One of the other installations on the same canal can deal with 11 cubic feet per second, or at the rate of nearly 6,000,000 gallons per day. We understand that other and considerably larger plants are now under construction on the same canal as well as in other districts.

CONSIDERABLE concern has been aroused in certain parts of New Zealand by the determination of Sir Joseph Ward, the Prime Minister and Minister of Finance, to cut down the railway programme and to concentrate on the completion of unfinished trunk lines, so that they may commence to earn revenue; also to institute a comprehensive system of transport co-ordination of road and rail services. Unprofitable lines are to be closed, provided there is road motor service to meet the public needs.

NEW BOILER SHOPS AT SCOTSWOOD-ON-TYNE

EDWARD WOOD AND CO., LTD., MANCHESTER, ENGINEERS



Armstrong Whitworth's New Boiler Shops at Scotswood.

AMONG important industrial developments in the Newcastle area is the recently completed large new boiler shop at the locomotive works of Sir W. G. Armstrong, Whitworth and Co., Ltd., at Scotswood-on-Tyne.

This building, the largest of its kind in the country for the manufacture of all classes of marine and locomotive boilers, presents numerous interesting features in design and construction. Having decided on the general lay-out, considerable attention was devoted to the modern requirements of space, lighting, heating, and ventilation, &c., also to the selection of a method of construction giving low capital cost and high practical efficiency and convenience. Ultimately an all-steel construction was adopted, and the contract for the whole of the constructional work of the new shops, including design and erection, was entrusted to Edward Wood and Co., Ltd., Ocean Ironworks, Manchester. The site of the building occupies an area of 13,700 square yards, fronting about 230 yards on the river Tyne at Scotswood.

Dimensions—In plan the building is 680ft. long by 181ft. 3in. wide, in three bays, the spans being 55ft. 2½in. for the centre bay, 62ft. 0½in. and 64ft. 0½in. for the north and south bays respectively. The height from floor level to underside of roof principal ties is 40ft. 6in., except in the centre bay for a length of 80ft. over the riveting towers, and for 320ft., starting from the west end, where the clear height is increased to 65ft. 9in. The height from floor level to the top of the ridge ventilators is 61ft. 6in. and 84ft. 6in. in the low and high bays respectively.

Crane Gantries.—Gantries for overhead travelling cranes are provided in each of the bays as follows:—In the north bay the span is 58ft. centres of rails, and the crane rail level is 30ft. above the floor, the cranes being two 10-ton, three 5-ton, and two of 3-ton capacity. In the south bay the gantry has a span of 60ft. centres at 30ft. elevation, and is served by four cranes, viz., two 20-ton, one 10-ton, and one 5-ton capacity. The centre bay has two gantries, one above the other, the spans being 47ft. 6in. and 50ft. 2in. centre to centre of rails, and the heights are 30ft. and 55ft. respectively above the shop floor. The lower gantry has five cranes, viz., one 15-ton, one 12-ton, two 5-ton and one 3-ton capacity. The high gantry in the riveting tower has two cranes capable of carrying loads of 15 tons and 30 tons, and the high-level gantry in the 320ft. long portion is served by two special heavy cranes, one of 50 tons and the other of 80 tons capacity. Most of these cranes were supplied by Craven Brothers (Manchester), Ltd., Vauxhall Works, Reddish, Stockport.

Main Stanchions.—The four rows of main stanchions are spaced 40ft. apart centre to centre longitudinally in each row, and are of compound H section, built up of R.S. joists and flange plates suitably connected together with diaphragms and lattice bracing of steel angle sections. The loads from the travelling cranes are carried directly on the stanchions, and from the main portion, lighter stanchions of similar section extend upward above the gantries to carry the roof girders. The stanchions rest on reinforced concrete foundations, and large bases of plate and angle construction are provided, with suitable anchorage bolts, to resist the overturning from wind pressure and cranes. The load on some of the high stanchions of the centre bay amounts to about 360 tons, and the weight of the stanchions varies from 3¼ to 8¼ tons each. Intermediate stanchions of H section at 13ft. 4in. centres, *i.e.*, two in each 40ft. bay, are provided in the sides, and also at both gables, to support the framing which carries the covering to the building. The main stanchions were designed for the maximum loading condition, *i.e.*, two of the heaviest cranes close together and acting simultaneously in both bays, a condition very seldom, if ever, likely to occur in actual practice.

Gantry Girders.—These girders are 40ft. long by 4ft., 4ft. 6in. and 7ft. 6in. deep, according to loading, and are of single web plate type, with stiffeners, and having wide flanges built up of plates and boom angles, bridge rail being riveted on top. The weight of these girders varies from about 4 tons to 8 tons each, the heaviest of which, supporting the 80-ton crane, has a solid bridge rail 106 lb. per yard. All gantry girders are designed for the maximum condition of the two heaviest cranes carrying full loading close together.

Roof Framing.—The roof principals, spaced at 13ft. 4in. centres, are of the type generally known as "French" trusses, composed of steel angles throughout, with gusset plates at joints, riveted in complete units, and having special framing at ridge for ventilators. The rise of the roofs is quarter pitch, or about 26½ deg. angle with the horizontal. The roof principals are carried on riveted truss girders, 40ft. span by 7ft. 6in. deep, framed between the tops of the stanchions. These truss girders are of parallel chord "Warren" type, with verticals, formed of steel angle and channel sections, with latticing and gusset plates complete. The thickness of all members was limited to a minimum of $\frac{7}{16}$in.; no ⅜in. material being used. The roof framework has a pleasing appearance, giving at once the impression of economical and rigid construction. Steel purlins of 4in. channel section are used throughout, except on the portion of the south roof slope, where 4in. by 3in. angle section purlins are used to carry sheeting.

Bracing.—The importance of the severe racking stresses caused by the heavy travelling cranes and side wind pressure, apart from the necessity of distributing local forces and the lining and squaring up of the structure, demanded careful attention to the arrangement and detailing of suitable bracing systems. Diagonal bracing of steel angles, in a horizontal plane, is fixed between the heads of the stanchions at the level of the bottom horizontal tie of the roof principals in the high portions, and similar horizontal bracing is provided in the form of longitudinal ties, and braced wind girders at eaves level in the low portions. The gable framing is also provided with horizontal wind girders, and diagonal bracing is fixed on the roof slopes to the rafters at intervals throughout the length of the building. Vertical diagonal bracing is also provided in certain panels between the high stanchions of the centre bay, extending down to ground level.

Lifting Beams.—To provide for lowering parts of the cranes for repairs, a lifting beam, fitted with shackle, is fixed between the apex of two of the roof principals in each bay. In the high portions of the building the beam is of 18in. by 7in. joist section, and in the low roofs the beam is 15in. by 6in. joist section to carry a central concentrated load of 20 tons and 10 tons respectively.

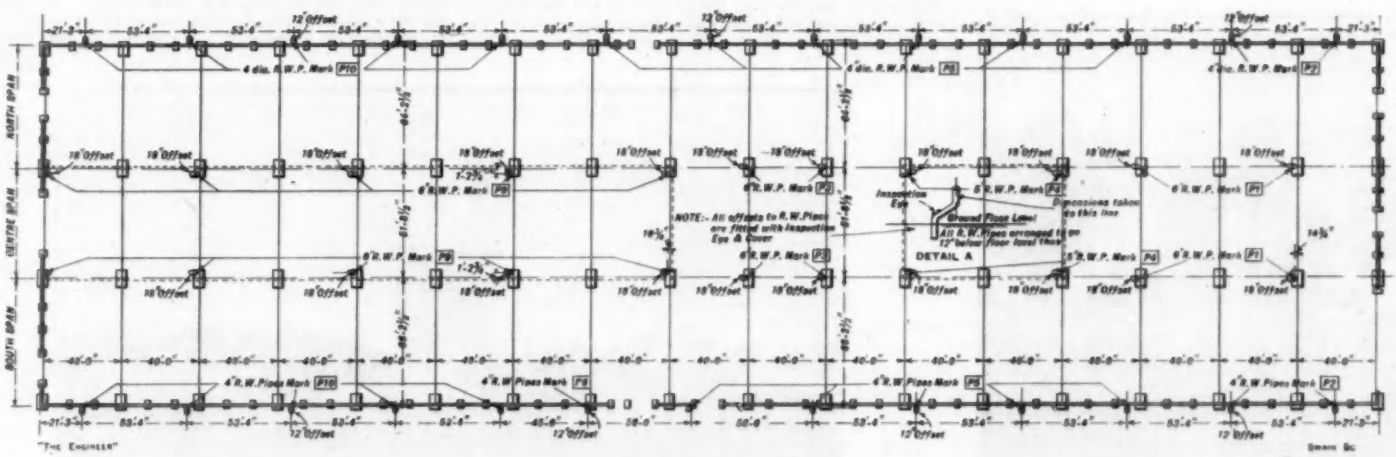
Roof and Side Covering.—The whole of the roofs, with the exception of the ventilators and on the south slope for a length of 480ft. from the east end, is covered with Mellowes and Co.'s roof glazing, having lead-clothed bars at 24½in. centres, and glazed with ¼in. wired glass, flashed at ridge and steppings with lead flashing, the total area of the glazing being 107,322 square feet. The roofs of the ventilators, the south roof slope, as mentioned above, and the whole of the sides and gables of the building down to top of the 6ft. high concrete surrounding wall, are covered with "Bell's Everite" corrugated asbestos-cement sheets, supplied and fixed by Weston and Co., Ltd., of Manchester. Ventilators, 40ft. long by about 15ft. wide, are provided in alternate bays, in each span throughout the length of the building, and are fitted with asbestos cement louvres on both sides.

Sliding Doors.—Mention must be made of the specially large doors, which are steel-framed and panelled with No. 18 gauge galvanised corrugated steel sheeting. The door in the centre of the west gable has a clear opening 30ft. wide by 25ft. high, and is formed in two leaves, the total weight of the complete door being about 3½ tons. It is fitted with 12in. diameter cast steel wheels with S.K.F. double ball bearings, running on a bottom rail of F.B. section, 25 lb. per yard. Each half of the door is easily opened or closed by one man. Another door of interest is at the east gable in the south span, which is 50ft. wide by 21ft. high, and is in six leaves, each 7ft. 10in. wide, arranged to run on two bottom track rails, to give a clear opening of 16ft. width in any position.

Gutters and Pipes.—The rain water from the roofs is carried in cast iron gutters, the section being 24in. by 7in. by ⅛in. metal in the valleys between the bays, and 18in. by 6in. by ⅛in. metal boundary wall gutter to the sides of high portions. The eaves gutter is 8in. half-round section, ⅛in. metal, and the rain-water pipes are generally 4in. diameter.

Timber snow gratings and cleaning gangways, the timber being creosoted under pressure, are provided to all the gutters, with hand-railing where necessary to eaves, gutters, and cat ladders extending over the roofs in certain positions give access for cleaning and repairs.

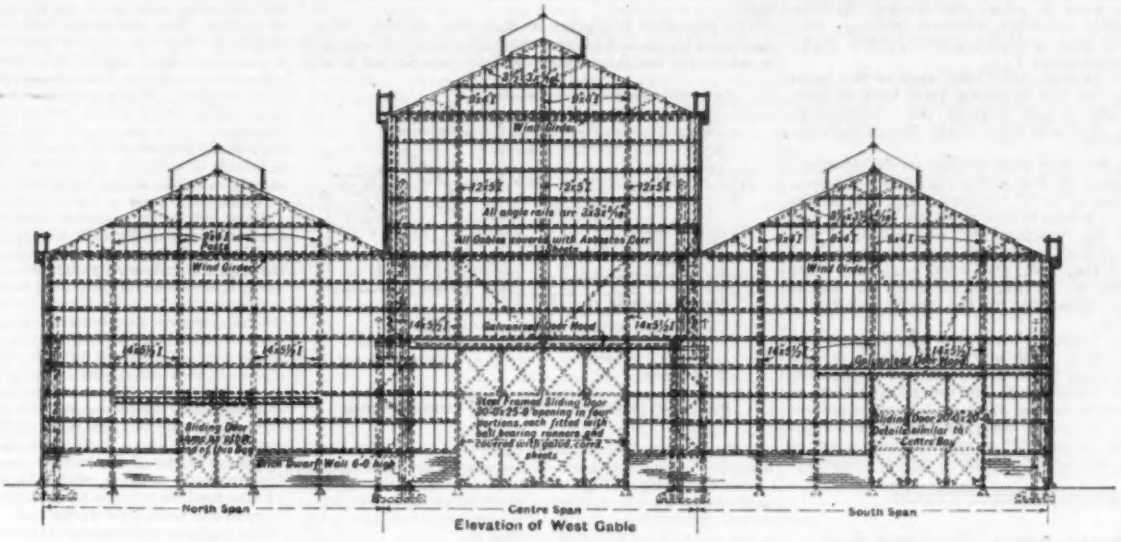
Foundations.—Owing to the close proximity of the river, and the uncertain nature of the water-bearing substrata, it was decided to adopt pile foundations to carry the heavy concentrated loads from the building stanchions. The concrete pile caps on which the stanchions rest are of various sizes, according to the load carried, such as 8ft. 6in. by 4ft. by 3ft. 6in. deep, 10ft. 6in. by 5ft. by

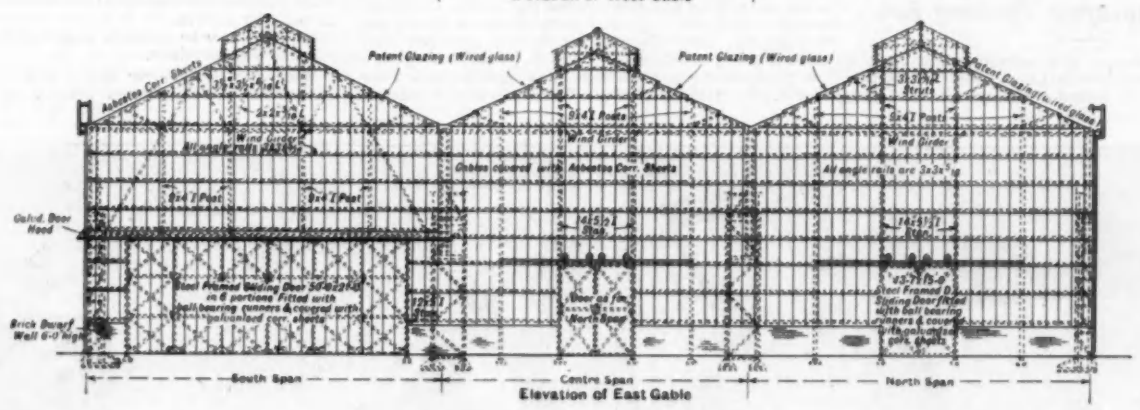


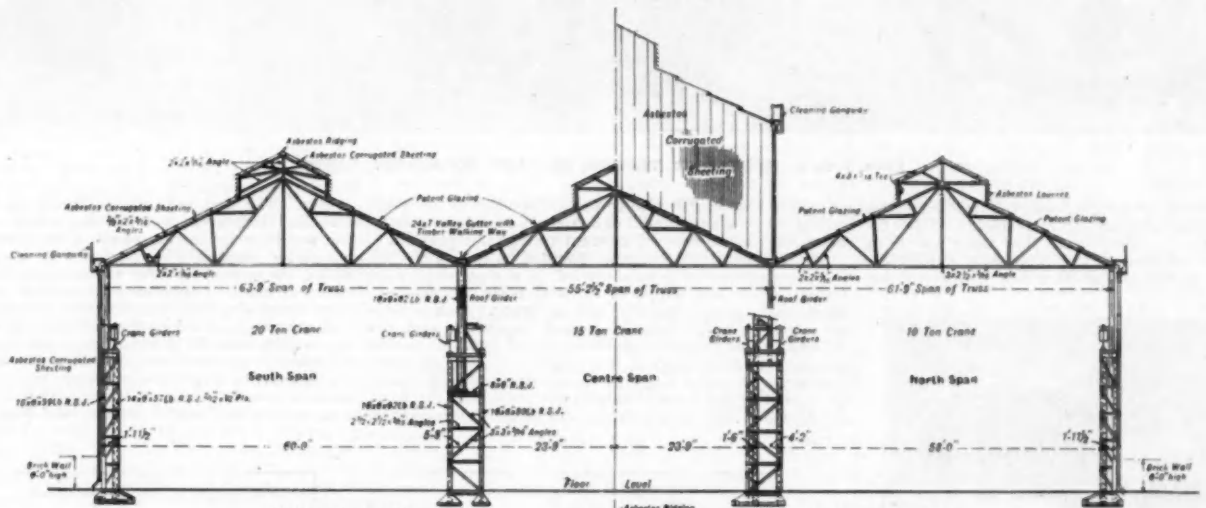
PLAN OF BOILER SHOPS

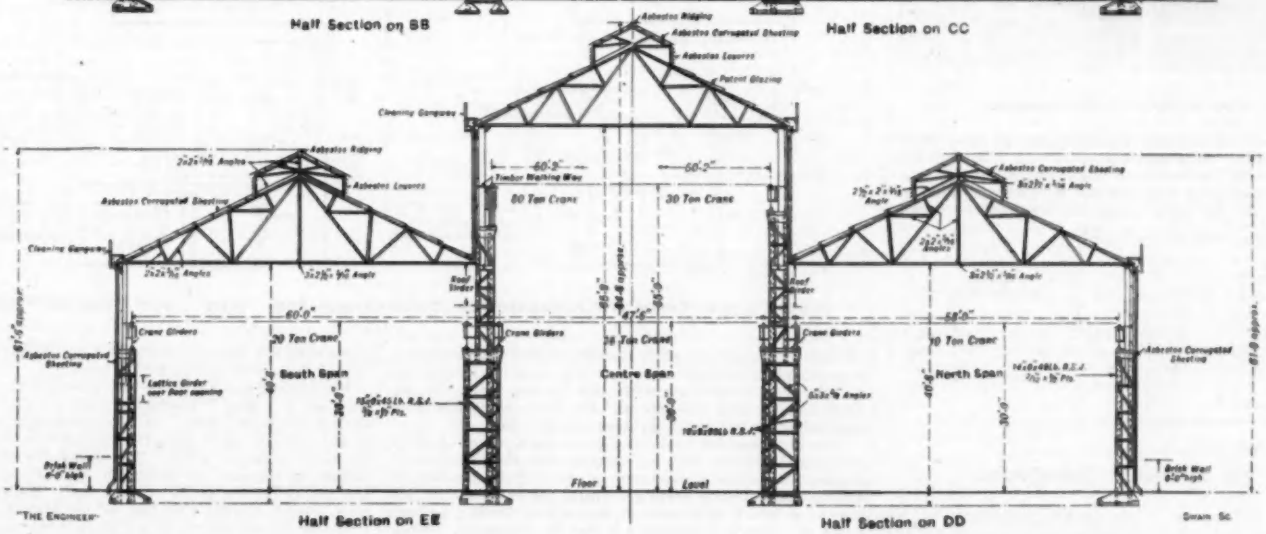
NEW BOILER SHOPS FOR SIR W. G. ARMSTRONG, WHITWORTH AND CO., LTD. AT SCOTSWOOD

EDWARD WOOD AND CO., LTD., MANCHESTER, ENGINEERS









3ft. 6in. deep, and 10ft. 11in. by 3ft. 9in. by 2ft. 9in. deep, &c. The cap slabs are of reinforced concrete, and are carried on groups of reinforced concrete piles, varying from two to six in number; all piles are 14in. by 14in. square section and 40ft. long. The reinforced concrete work was designed by L. G. Mouchel and Partners, Ltd. (Hennebique Ferro-concrete), of Newcastle and London, and the whole of the foundation work, including excavation and concrete work in piles, pile driving, pits for drilling, and riveting machines, concrete flooring, &c., was carried out by Purdie, Lumsden and Co., public works contractors, of Newcastle-on-Tyne.

The whole of the constructional steel work of this large building, requiring the use of about 1600 tons of steel and including the glazing and covering, was completed in thirty-two weeks; that was eight weeks before the contract date expired.

The plans of the building were subject to the approval of Mr. John Ferguson, M. Inst. C.E., consulting engineer, of London, a director of Sir W. G. Armstrong, Whitworth and Co., Ltd. The whole of the work on the site was carried out under the direction and supervision of Mr. J. Sopwith, M. Inst. C.E., the firm's chief engineer, and Edward Wood and Co., Ltd., structural engineers, were represented by Mr. T. McGill, M.I. Struct. E., A.M.I. Mech. E., who was responsible for the design and detailing of the steel work.

The result is an imposing structure, standing on the north bank of the river Tyne at Scotswood; it is now equipped with the most up-to-date tools and appliances, and is one of the finest plants for the manufacture of marine and locomotive boilers at present in the country. On page 259 and herewith we give various drawings of the structure, and on page 252 we reproduce a number of photographs taken during the construction of the building.

A New Resistance Testing Set.

NEARLY seven years ago, to be precise in our issue of October 13th, 1922, we described the "Meg" insulation tester, introduced by Evershed and Vignoles, of Acton, to meet the demand for a light, compact, and relatively cheap high-resistance measuring instrument. That the makers were correct in their belief that there was a big field for such an instrument, the experience of the sales department has shown, and another new instrument has now been introduced that would appear to meet another long-felt want. This latest product, the "Bridge Meg," not only serves for insulation tests, but is also capable of measuring conductor resistances. By the operation of a simple switch, the instrument can be made to measure insulation resistances or conductor resistance by the "Bridge" method. It consists of an ohmmeter and 500-volt generator of the "Meg" type, combined in one case with a set of resistances. The "Meg" range is 100 megohms to 10,000 ohms, and the "Bridge" range 999,900 ohms down to ·01 ohm. The total weight of this self-contained instrument is 12¾ lb.; its dimensions are 7in. by 8¾in. by 12in.; and it can be carried by hand or slung from the shoulder. A picture of the instrument ready for use is given in Fig. 1. The generator is shown in Fig. 2, the ohmmeter movement in Fig. 3, and the change-over switch and ratio switch in Fig. 4, the ratio switch being on the left of the picture and the change-over switch on the right.

The generator is similar to that used in the "Meg" insulation tester, and has two windings which are connected in series for insulation tests and in parallel for bridge measurements. The voltages generated are 500 for meg tests and about 250 for bridge tests. From the turning handle on the right (Fig 1), the drive is transmitted through steel cut gears enclosed in an oil-tight casing, and a free wheel interposed between the handle and armature allows the latter to come to rest slowly when the handle is released, so that it is impossible to damage the generator by stopping it suddenly. Between the handle and armature shaft there is also a constant speed clutch, so that the speed of the generator remains constant at all handle speeds above that at which the clutch slips. During tests on insulation, in which appreciable electro-static capacity is involved, and in the final adjustment of balance in a bridge measurement, the maintenance of constant voltage is important.

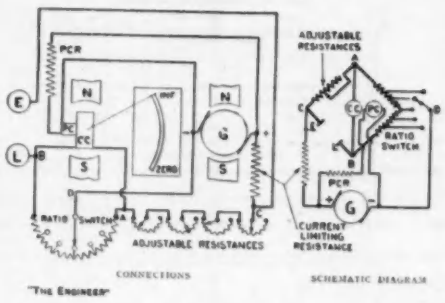


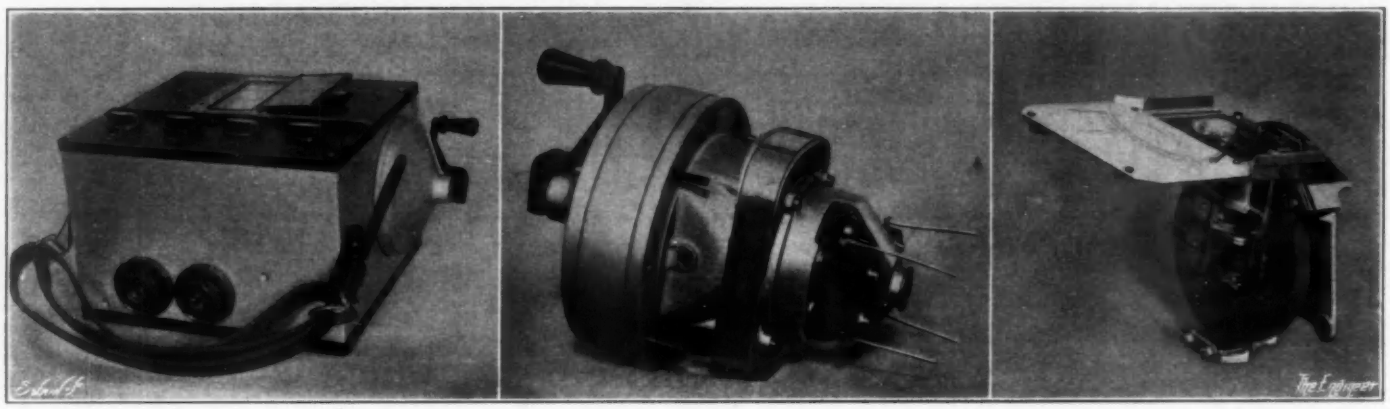
FIG. 6—"BRIDGE" SETTING CONNECTIONS

The ohmmeter moving coil is mounted on an axle pivoted in spring-supported jewels carried in a cast aluminium frame, which also supports the dial plate, an arrangement that ensures rigidity and accuracy. Connections are made through spirally wound ligaments, and for all intents and purposes the movement is free. To ensure accuracy in the event of any slight variation in these ligaments, an index adjuster is provided and is operated by a small screw accessible from the outside of the case. By means of this simple device the field surrounding the pressure coil can be slightly distorted by the movement of a small piece of soft iron. As the index adjuster has no physical connection with the moving coils, its use cannot injure the instrument. The scale graduations are marked on a matt white surface on a zinc dial.

The change-over switch—Fig. 4—is a drum switch, with fixed brushes making contact with the drum which carries the contacts necessary to connect the brushes for the meg and bridge settings, whilst the ratio switch has two arms which slide between the sets of studs. In both cases the switch positions are clearly indicated. While considerably lighter and smaller than the resistances in the resistance box of the well-known "Bridge Megger" set, the adjustable resistances in this new instrument are equally efficient in their operation. In all there are four sets of these adjustable resistance units, for units, tens, hundreds, and thousands, giving values of 1 to 9999 in steps of one unit and the value corresponding to a given setting of the dials can be read by numbers seen through small windows in the case. When connected as a "Meg" the instrument consists of a generator, which supplies the current and a direct-reading ohmmeter which measures the unknown resistance, the arrangement being as shown in Fig. 5. The ohmmeter has two coils, the current or deflection coil C.C., and a pressure or control coil P.C. mounted at right angles on a common shaft and free to move in a magnetic field provided by a permanent cobalt steel magnet. These coils are wound so that when they carry current they tend to rotate the movement in opposite directions, with the result that the final position of the movement represents a balance of the forces. The pressure coil is directly connected across the generator terminals in series with a high resistance of fixed value, and it therefore exerts a force proportional to the applied voltage, whilst the current coil is connected in series with the resistance under test, across the generator terminals, and it therefore exerts a force proportional to the current through the unknown resistance. When this resistance is infinite, current will only flow in the pressure coil circuit, and the pressure coil will take up a position at right angles to the magnetic flux between the poles of the permanent magnet, and in this position the pointer attached to the movement will indicate infinity. When, on the other hand, the unknown resistance is zero, the current passing to the current coil will deflect the movement in the opposite direction, and the forces are such that the pointer will come to rest opposite the zero point on the scale. For any finite external resistance a balance is obtained between the opposing forces of the current, and pressure coils in some intermediate position, which is determined by the ratio of the applied voltage to the current passing—that is to say, to the resistance under test. Since the final position of the pointer only depends on the resistance of the external circuit, the instrument is a true ohmmeter. The scale extends from 0 to infinity, and is divided from 10,000 ohms to 100 megohms.

When the change-over switch is set to "bridge," the instrument is transformed into a simple Wheatstone bridge. The two ratio arms—Fig. 6—and the rheostat form the three arms of the bridge, which is completed by the resistance to be measured. The current coil of the ohmmeter coupled to the mid-wire serves as the galvanometer, the control force for which is provided by the pressure coil which is supplied independently from the generator terminals. When no current is passing in the current coil, the force exerted by the pressure coil brings the moving system into the position in which the pointer reads "infinity," as described, so that the infinity reading corresponds to a balanced condition of the bridge. Fig. 7 shows a complete diagram of connections with the change-over switch on "meg" setting, and Fig. 8 the connections with the change-over switch on bridge setting. The dotted lines show the guarding system.

For testing insulation the instrument is used in the same way as a "meg" insulation tester. The change-over switch is set to "meg" and the terminals are connected to the line and earth or to the second wire, if the test is to be made between wires. The generator handle is then turned at the rate of about 160 revolutions per minute, and the indication on the scale is read. The position of the ratio switch during this test is immaterial, as it is disconnected from the circuits. If the resistance under test should prove too low for accurate reading on the dial or if the resistance of a conductor is to be determined, the operator can set the change-over switch to "bridge"



FIGS. 1 TO 3—RESISTANCE TESTING SET AND COMPONENT PARTS

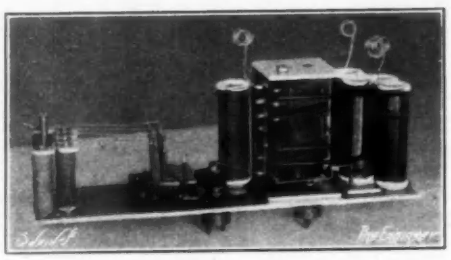


FIG. 4—SWITCH MECHANISM

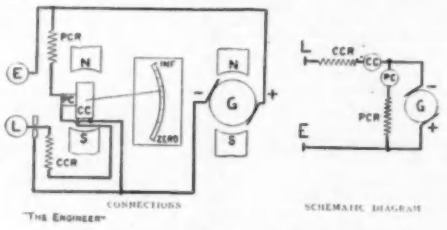
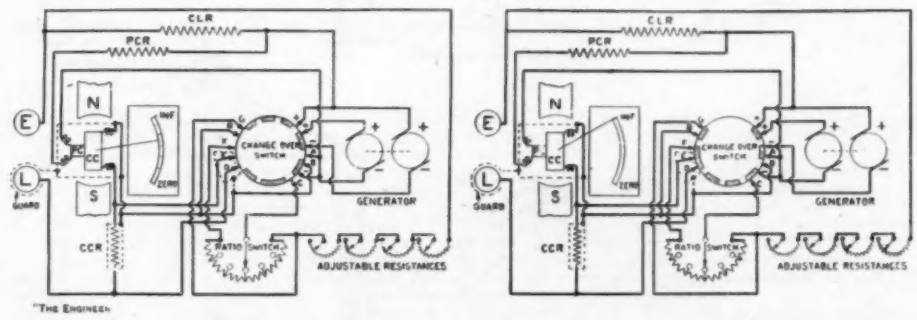


FIG. 5—"MEG" CONNECTIONS



FIGS. 7 AND 8—COMPLETE DIAGRAMS OF CONNECTIONS FOR "MEG" AND "BRIDGE" SETTINGS

without altering the external connections, and having adjusted the ratio switch to a suitable ratio, he turns the generator handle while adjusting the rheostat by means of the knobs, until the pointer is opposite the infinity mark on the dial. To ensure the maximum sensibility, the speed of the handle should be increased to at least 160 revolutions per minute before the adjustment is finally concluded. When multiplied or divided by the factor shown by the position of the ratio switch, the figures seen through the windows alongside the adjusting knobs give the value of the resistance measured.

Atlantic Outlet for Rhodesia.

TOWARDS the end of June an important expedition was dispatched into the Kalahari Desert to ascertain the possibility of constructing a railway from Rhodesia to Walvis Bay, so as to provide Rhodesia with a port on the Atlantic, and thus reduce the land and sea journey to Britain and the Continent, as compared with that entailed by exporting through Beira, Portuguese East Africa. The expedition, which was under the leadership of Captain the Hon. B. E. H. Clifford, representative of the British Government in South Africa, left Francistown, accompanied by Mr. C. P. J. Fry, of the Rhodesian Railways, and Mr. MacGregor, of the Southern Rhodesian Geological and Survey Department. At the suggestion of Sir John E. Thornycroft, an "A 4" type of Thornycroft lorry, equipped with a specially large radiator, water condenser, and special oversize Dunlop tires, with particularly thick treads, walls and inner tubes, was employed. Captain Clifford gives great praise to the vehicle, and states that they had no trouble with punctures, which had proved a serious obstacle on a previous expedition, and that the petrol supply was never even in danger of becoming exhausted.

The information available at the start was that no serious physical obstacles need be anticipated west of Bakops, on the Botetle River, but the nature of the country east and north-east of that place presented difficulties. It was known that the Great Makarikari Salt Lake, which was partially flooded each year, sprawled over a vast area of country. This lake has been shown vaguely on maps from the earliest times, but its shape, the limits of its boundaries, and the extent to which it might be regarded as an obstacle in railway construction was unknown. It was clear that until the boundaries of this lake were definitely fixed all suggestions for a railway route must be purely speculative. The Bechuanaland Protectorate authorities, too, were desirous of obtaining information of the general nature of this country, and as an outcome of discussions between the Governments of Rhodesia and the Bechuanaland Protectorate, the expedition of which Captain Clifford was placed in charge was organised.

About 128 miles out of Francistown the expedition came to the edge of the Great Salt Lake. There Captain Clifford made the discovery that although they only just touched the lake, they were, according to astronomical observations he made, already at a point which, on the best map available, is marked as a quarter of the way across it. The lake presented a wonderful sight, as, owing to heavy rains in Rhodesia, it was flooded with water. Yet the expedition was able to cross a dry arm of the lake in a north-easterly direction. There was a considerable amount of heavy going, and when the expedition later came upon the lake again the expedition had an extremely narrow escape from disaster, for while heading for some grass islands the surface underneath them gave way, and it was only with great difficulty that the lorry was raised and got back to firm ground.

In spite of all obstacles, the expedition finished an important survey of a large unexplored and potentially valuable area of the Kalahari. With regard to the rough survey made for a railway route, Captain Clifford feels confident that a railway is not merely possible, but particularly feasible. He estimates that a line, slightly deflected round the lake, which does not stretch nearly as far north as was expected, could be laid down at a cost of £4000 a mile, since there are no serious physical obstacles, and the country is unbroken and extraordinarily level. Ultimately, Captain Clifford is convinced a railway will have to be built that way. At the moment, with one exception, all the railways in British South Africa feed the East Coast. There are valuable tracts of Crown land to be opened in Bechuanaland, and that fact, combined with the necessity of bringing Rhodesia nearer Europe and the sea, is regarded as making a railway across the Kalahari inevitable. It may be added that the expedition has fixed the salient features of the lake by astronomical observations and compass traverse. The feasibility of a route either north or south of the lake is established. A full report will be drawn up and submitted to the High Commissioner.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

More Inquiry.

THE incoming of September has brought a renewal of inquiry for iron and steel, and there was a slightly higher level of activity at the weekly meeting of the Midland iron trade in Birmingham this week. The amount of business done up to now is of no great magnitude, but it leads to the belief that a reinvigoration of trade may be expected before the month is out. The flow of specifications for pig iron supplies, together with the orders being received, are sufficient to absorb the output of Midland furnaces. Orders for finished iron are fairly regular, and mills are well employed, while the structural steel department, which has been notably quiet for some months, gives evidences of awakening activity. Manufacturers in the Midlands and Staffordshire users of iron and steel are nearly all hopeful for the immediate future, and engineers profess to see brighter business ahead. Industrialists generally, however, fear to be too optimistic; they have witnessed the falsifying of their beliefs many times of late—and are exercising a certain amount of caution in their transactions.

Raw Iron Prices.

Consumers of pig iron in this district welcomed the decision of blast-furnacemen, come to last week, to maintain prices at recent levels. There was known to be quite a strong body of smelters who favoured a further advance, and buyers had been warned of the imminence of a higher range of selling terms. The associated producers, however, after consideration of the advisability of such a move, decided to leave the official minimum selling price as it was last week. Consumers of pig iron have in many, if not in most cases, been unable to pass on to the consumer of their finished goods the recent advances paid by them for raw material, and the increase in production costs generally has been such as to deprive them of the greater proportion of the profits on their output. Had pig iron been again raised there is little doubt but the users would have been compelled to put up their prices by at least equivalent amounts, and this they had no desire to do in the present state of the market. Consumption at the foundries is increasing slowly. Some branches of the founding industry are steadily employed, and foundrymen take a hopeful view of the future. Both foundries and forges, however, have secured a good proportion of the raw material they are likely to require for another month or so. Nevertheless some inquiries are circulating, and good tonnages are being supplied on contracts entered into some time ago. The relaxing of the pressure for basic pig may have an important effect upon the output of forge and foundry irons, as a number of furnaces which ordinarily produce these grades of iron and were put on basic may now return to the production of their usual brands. On 'Change in Birmingham to-day—Thursday—raw iron values were very firm. Derbyshire No. 3 foundry is quoted £3 16s.; and Northamptonshire, £3 12s. 6d. per ton delivered Black Country stations. No. 2 foundry is 2s. per ton more in each case, and No. 1 3s. per ton more. Forge brands are 4s. per ton below the price of No. 3 foundry. East Coast hematite ranges from £4 10s. 6d. upwards, and West Coast from £4 12s. to £4 13s. 6d., delivered here.

Staffordshire Iron Trade.

The call for Staffordshire marked bars shows improvement, but whether this is due to an advance in consumptive demand or to the possibility of an increase in bar iron prices, it is difficult at the moment to determine. Up to the time of writing no move had been made by Staffordshire ironmasters towards an upward change in selling values, but such action in the near future is anticipated. Mills are moderately placed for business, and are very hopeful for the future. Marked bars are quoted £12 per ton. Little activity is displayed in the Crown bar department. Makers of this class of iron, with rising production costs and a slow market, are experiencing difficulty in imposing prices of a profitable character. Competition is keen, and ironmasters hereabouts are fortunate if they are able to maintain recent rates of £10 to £10 5s. Crown bars from districts outside are procurable at as low as £9 15s., so that Staffordshire producers have no easy task to induce users to purchase from them at the higher price. In the common bar department continental competition is slightly less keen. Belgian No. 3 iron, used in the Black Country bolt and nut and fencing trades, is from 1s. to 1s. 6d. per ton up, compared with a week ago. The price is still 45s. or so below that of £9 to £9 5s., the Staffordshire makers' price. The bulk of the business continues to go to the foreigner. Demand for wrought iron strip is good, and rollers are in a strong position. They now ask £11 2s. 6d. per ton for their output, and few are prepared to accept less. Pig iron costs, they assert, make this selling price imperative if they are to get a profit.

Steel Demand.

After a quiet period of several months there is now evidence of an improving demand for structural steel. Inquiries are becoming quite numerous, some have developed and structural steelmasters are encouraged to look for a reinvigoration of consumptive demand in the very near future. Finished steel quotations are unchanged, angles and joists being officially £8 2s. 6d., and ship, bridge and tank plates £8 17s. 6d. Boiler plates are worth £9 12s. 6d. per ton, and demand is fair. The call for special steels for the motor engineering firms is not so good as it was, but the lull is, it is believed, only temporary In the semi-finished branch local makers are hardly holding their own against the foreigner. In various directions foreign steel is attracting attention, price disparity acting as the deciding factor. A substantial volume of business is reported to have gone to the Continent, both for bars and tube strip. Foreign strip is offered at £7 6s. upwards against the home quotation of £8. Imported billets are named £5 14s. for 2½in., and £5 15s. upwards for 2in., against £6 7s. 6d. quoted by Welsh mills, and £6 10s. to £6 12s. 6d. by English mills. Native billet makers are, however, in a fairly strong position.

Sheets.

The galvanised sheet trade remains disappointing, both home and export demand being more than usually quiet. Some good business on overseas account had been expected ere this, and mills are getting very short of work. Rollers this week express some anxiety as to the immediate future. They maintain prices at the basis of £13 7s. 6d. for 24-gauge corrugated sheets, being satisfied in their own minds that consumptive demand at the moment is such that a price reduction would not sufficiently pay for itself by any increase in business which would result. Now that September is here reinvigoration of demand should not be much longer delayed. A few inquiries have been in circulation this week, but they have not generally referred to large scale supplies. Demand for thinner gauge sheets is similarly poor, while there has also been a falling off in sales of black sheets to the Midland automobile engineering firms.

Scrap.

Heavy steel scrap continues in demand, but buyers are not prepared to pay the high prices which ruled a short while ago. Indeed, they quibble at £3 16s. and £3 17s. 6d. now asked by Birmingham merchants for supplies, and have in some instances been successful in getting orders accepted at slightly lower rates. Generally speaking, however, sellers are not prepared to go below the lower figure quoted above. Practically all business is the subject of "offers" and "counter offers" on the part of buyers and sellers.

Edge Tools.

The heavy edge tool industry in the Staffordshire district is experiencing another quiet period. Business, though on the whole good, has been patchy throughout the year, and at date, though there are excellent inquiries in circulation on account of overseas buyers, the actual work in hand is small, and some large works have difficulty in keeping their hands regularly employed. Indeed, in at least one case, men have had to be suspended. Firms in South Staffordshire specialising in plantation tools for the South American market report that they have done a good volume of business, but are not so well placed as they were. Markets which give promise of good business in the near future are Uganda and Kenya, Australia and South Africa. The Eastern position, which has been very uncertain for months past, is said to have improved, and the outlook is rather better than it has been at any time during the present year. The small tool trade in this district continues good, despite the somewhat dull conditions ruling in some branches of engineering.

Cannock Chase Coal.

There was an average loss of 6¾d. per ton on all coal produced in the Cannock Chase and Pelsall coalfield in July, as against a loss of 1s. 4·47d. in June and 1s. 1·18d. in May. The wages of miners in the area, which are based on the ascertainment for May, June and July, will remain at the minimum rate of 42 per cent. on the 1911 basis, although the ability of the owners to pay is only 11·23 per cent. The owners' accumulated deficit now stands at £1,024,863, an increase of £44,978 on the month. The trade at date shows signs of improvement, the number of hands employed at the pits having increased by some 2000 during the past fortnight.

£80,000 Contract for Smethwick Firm.

It is learned that Henry Hope and Sons, Ltd., of Halford Works, Smethwick, have been given a contract amounting to over £80,000 in connection with the roofing of the new Ford works at Dagenham, Kent. The contract consists of the whole of the roof lights, the patent glazing, and the electrically-operated opening gear. This order is one of the largest received by a Midland firm for some time.

5 G.B.

The British Broadcasting Corporation's decision, announced this week, that 5 GB shall become a definite part of the regional scheme, will, I understand, possibly entail a reconstruction of the existing station, which is only a temporary structure erected for experimental purposes. It is considered to be hardly suitable for a permanent station.

Unemployment.

A further welcome and substantial decrease in the number of workless in the Midlands area is shown in the latest available returns. The total fell on the week from 171,357 to 161,595. This follows upon a reduction in the previous week of 12,424. The Birmingham figures, which a week ago were moving in the wrong direction, have just about held their own, the total being 25,059, against 25,062 a week ago. Decreases are recorded at Bilston, Coventry, Cradley Heath, Derby, Dudley, Leicester, Northampton, Peterborough, Redditch, Stoke-on-Trent, Stourbridge and Brierley Hill, Walsall, Wednesbury, West Bromwich, Wolverhampton, and Worcester. Of the total unemployed in the area 117,016 are men.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

A Railway Scheme Revived.

THE revival is reported of a scheme which was under consideration some time ago to place the three towns of Ashton-under-Lyne, Dukinfield, and Stalybridge, on a direct railway line between Manchester and London. To do this, a new line about 6 miles in length would have to be constructed from Stalybridge to a point between Hadfield and Crowden on the London and North-Eastern main line from Manchester to London. The scheme would involve the construction of two new tunnels and four viaducts, and the estimated cost is put at between £300,000 and £400,000. If it matures, the new line is expected to prove of considerable advantage to the towns in question, from the point of view of both passenger and goods traffic. It is proposed to promote a Bill in Parliament at an early date, and application is to be made for a Government grant towards the cost. As a means of alleviating to some extent the unemployment situation in the areas concerned, negotiations are to be opened up with the municipal authorities of the three towns with the object of securing their official support of the scheme.

Road Construction Schemes.

There seems to be no end to the number of schemes that are being evolved as measures of unemployment relief, the majority of them being concerned with road construction. In addition to those that have been briefly outlined in this column during the past month or so, including that involving the expenditure of well over £800,000 which will come before the Manchester City Council this week for approval, a number of others affecting various Lancashire towns have been under discussion during the past few days. The most important of these is that of the Rochdale Town

Council, which, over a period of five years, proposes to spend about £220,000, chiefly on road construction, subject, of course, to financial aid from the Ministry of Transport, and also £10,600 on a sewage disposal scheme. In addition to £143,000 to be spent at Blackburn on a new outfall sewer, heavy expenditure on roads is under consideration by the local authorities. A new road, the estimated cost of which will be slightly more than £65,000, is planned by Heywood Town Council, and application for grants in aid are to be submitted to the Ministry.

Omnibus or Trackless Tram ?

Arising out of the recent decision of the Manchester City Council to permit the Tramways Committee to borrow the sum of £110,000 for the purchase of double-deck motor omnibuses to replace single-deck tramcars on what is known as Route 53, which runs from Cheetham Hill to Belle Vue and other parts of Manchester, the Lancashire and Cheshire branch of the Roads Improvement Association has passed a resolution requesting the Manchester Tramways Committee to consider the provision of six-wheel trackless tramcars instead of petrol-driven omnibuses.

Liverpool Wants Industries.

Not content with being merely a leading shipping centre, Liverpool is making an ambitious attempt to attract to the city new industries and extensions to existing ones. Although not nearly so important as Manchester from the point of view of engineering industries, Liverpool has, nevertheless, already a formidable sprinkling of them. Still she is out for more factories and workshops of all kinds, and Mr. Matthew Anderson, the energetic manager of the Liverpool Organisation, a body which was established several years ago for the purpose of stimulating trade developments in the city, is making a special visit to the United States with the express object of telling American business men why they should select Liverpool and its neighbourhood as a manufacturing centre. Within the next two months, Mr. Anderson tells us, it will be decided whether Liverpool is to have not merely one factory, but a whole group of factories—indeed, the beginning of an industrial estate.

The Municipal Aerodromes.

Work is proceeding actively on the construction of the Manchester Corporation's aerodrome at Chat Moss, but some doubt has been expressed this week as to whether it will be completed by the end of next month, which was the time limit announced by the Aerodrome Committee for its completion. It appears that progress has been delayed by the difficulty in obtaining certain special girders. The types in question are made only by two firms in this country, but there is such pressure of work on both of them that delivery of the material is being held up. Meanwhile, Liverpool's venture in the same direction is awaiting financial assistance from the Unemployment Grants Committee before active steps can be taken.

An Engineering Appointment.

Mr. W. E. Grundy, of Blackburn, who, since 1911, has been in private practice as consulting engineer and mill architect, has been appointed chief engineer and consultant to the Lancashire Cotton Corporation, which was formed recently for the purpose of amalgamating a large number of cotton mills in the county. In the course of his career, Mr. Grundy has served successively at the Birkenhead yard of Cammell Laird and Co., the Horwich locomotive works of the former Lancashire and Yorkshire Railway Company, and with Clayton, Goodfellow and Co., Ltd., mechanical engineers, of the Atlas Ironworks, Blackburn.

Non-ferrous Metals.

Non-ferrous metal market conditions during the past week have been by no means of a uniform character. The copper section on balance is appreciably dearer, and has more than recovered the ground lost in the previous week. Lead has registered an important advance, but both tin and spelter have sustained fairly heavy losses. In the case of copper, standard brands of the metal are nearly £2 a ton higher. To some extent, the rise is attributed to political developments, though there has also been evidence of improvement in buying conditions. Refined copper has attracted more attention, a better demand having developed from the cable-manufacturing industry. Current values of standard are the highest recorded since early in June. Although an improved call for the metal is expected in the case of tin, it has not yet been experienced, and prices have declined characteristically to the extent of about £4 a ton. Quotations, however, are still appreciably better than they were three months ago, before the last improvement set in. Lead values have moved upward under the influence of bigger buying, though much of it has been of a speculative nature, and are now higher to the extent of about 10s. a ton compared with a week ago. Transactions in spelter, in view of the uncertain outlook for the metal, are extremely cautious and further weakness has set in.

Iron and Steel.

Occasional new orders for foundry iron have been reported on this market during the week, but they do not by any means signify the beginning of a fresh general buying movement. At the moment, however, certain of the largest producers of pig iron in the Midlands are more concerned with keeping pace with the current call for deliveries of material than in adding to the orders already on their books. Blast-furnace stocks are low, and as big quantities are being absorbed in associated undertakings of producers, no little difficulty is being experienced in maintaining deliveries to consumers who, in this district, at all events, seem to be specifying for bigger tonnages. Quotations are very firm, but so far there has been no alteration in the position. With regard to steel, a rather more optimistic view is being taken of the prospects locally, due, in a large measure, to the fact that constructional engineers' requirements during the past week or so have shown an expanding tendency. Locomotive engineers continue to add to the work in hand, and are steadily calling for steel materials. In other respects there is a fair aggregate movement. Up to the present, however, apart from occasional replacement contracts, new business in steel has been rather scanty. From the point of view of consumers, continental steel is now being quoted at attractive levels, and an improvement in the demand in this section of the market is expected to develop before long. In the meantime, there has already been a slight expansion in the demand, both for semi-finished and finished products compared with that ruling for several months.

BARROW-IN-FURNESS.

Hematite.

There is little change in the hematite pig iron trade in this district, and makers are fairly well booked, not only for production in the immediate future, but fairly well ahead. There is some grumbling at the price which obtains, and makers assert that there is very little margin left for profit. To a certain extent the East Coast is responsible for this. The competition from that side is keen, and it compels West Coast iron producers to keep their prices down. Owing to the weak state of the steel trade, iron requirements in the district are very small, with the result that more iron is now in the market. This may mean more business being done with America. Many steamers which discharge in this country and have to cross the western ocean cut freights on pig iron, with a view to obtaining ballast, and this operates in favour of trade with America. The business done in special qualities is well maintained, but manganese alloys are weak. Continental business is about the same. There is no change in the iron ore trade. Local demands are about the same, and there is a fair business with Scotch and East Coast smelters. Foreign ore remains about the same. The steel trade is very weak. The Barrow rail mills are idle, and there is no sign of their restarting. At Workington there is a certain amount of activity, but not sufficient to keep the mills going regularly. The hoop mills at Barrow are better situated, and hold contracts mostly on overseas account, which will keep them going regularly.

SHEFFIELD.

(From our own Correspondent.)

Steel Trade Prospects.

THE next few weeks will show whether the optimism which has prevailed in the steel and allied trades of Sheffield during the past month or two is justified. The usually dull period of the year has been passed fairly satisfactorily, although very little progress has been made, and it now remains to be seen whether the hoped-for revival will take place. Undoubtedly there are some indications of improving trade, particularly in connection with special lines, and it seems likely that the autumn and winter will see better trade conditions generally. Some doubt is creeping in, however, for the majority of the works are not busy at the present time; many firms are badly off for work, and unemployment in Sheffield was worse during August than during the same month of last year. There continues to be a poor demand for acid steel, and there has been no improvement in the call for railway materials, but furnaces producing basic steel are working well both here and in North Lincolnshire. It is the demand for special steels which is most encouraging, and there is some reason for congratulation in this respect, for local manufacturers have done very well in adapting themselves to modern requirements. Special forgings are in good demand, and there is considerable activity in such local products as motor steels and parts, magnet steel, permanent magnets, strip, wire rods, high-grade wires, &c. If some improvement comes in the ordinary heavy departments recent optimism will be justified.

High-speed Steel Costs.

A disquieting feature recently has been the increase in the price of tungsten. There are indications that the advances may be maintained, and this will be a serious matter, inasmuch as tungsten is an important ingredient of high-speed steel. Prices for tungsten are now more than twice as high as they were at the beginning of the year, and it may be that they will bring about higher prices for the steel. In that case manufacturers would have difficulty in maintaining their present position for competition in the high-speed steel trade has been very keen lately, both at home and abroad.

Peace Instead of War.

The way in which factories that played so very important parts during the war in providing munitions, &c., have been adapted to meet the needs of peace time is exemplified by developments at the well-known River Don Works (Sheffield), of Vickers, now in the English Steel Corporation. Military tanks have been manufactured here in the past, but the last tanks to be made in Sheffield are now being completed, and this branch of the work is being transferred to the Tyneside works of the combine. But other manufactures are being rapidly developed. For instance, the heavy section manufactures oil cracking and reaction chambers, and high-pressure steam boilers, and undertakes much casting, forging and engineering work which resembles, in many respects, gun production. Recent progress has been considerable.

Steel Chain for St. Paul's.

Brown Bayley's Steel Works, Ltd., Sheffield, have received an order for a large stainless steel chain to be used as a tie in the dome of St. Paul's Cathedral. It will be remembered that about a year ago this firm produced a similar chain, 450ft. long, and weighing 30 tons, which was used by the engineers in charge of the preservation work at St. Paul's to encircle and strengthen the dome just below the Whispering Gallery. The new chain, which is to be finished in January, will be considerably longer and will weigh about 60 tons. The rust-resisting and other special qualities of the chain now in position have proved entirely satisfactory, so that it will probably strengthen and support the dome for centuries. The new chain is required for a different section of the dome.

Stainless Steel Uses.

Many local firms are specialising in new uses of stainless steel, and Hadfields, Ltd., Sheffield, have made considerable progress in the production of non-corrosive steel and iron. Various purposes for which the steel is used in engineering and allied trades require varying qualities, and the manufacture of these products has had to be brought to a remarkable degree of fineness. High chromium steel, in its mechanical properties and heat treatment, is comparable to the usual carbon and alloy structural steels, but to serve the whole range of purposes for which the more ordinary structural steels are employed, it is necessary for stainless steel to be available in all hardnesses and with tenacities of from 35 tons to 100 tons per square inch. It is obviously impossible to meet all these requirements with only one steel, and Hadfields' steels are produced in four separate grades.

Huge Ingot Mould Casting.

Made by the Brightside Foundry and Engineering Company, Newhall-road, Sheffield, for the English Steel Corporation, a giant ingot mould casting, weighing over a hundred tons, attracted considerable attention when it was hauled by five traction engines through the streets of Sheffield to the River Don Works of the last-mentioned firm. This casting, which is the largest of its kind the Corporation has had, is to be used for making ingots for boiler drums up to 160 tons in weight. Its manufacturers have recently met with better trade in various departments. Good contracts have been booked by the firm for pipework for large generating stations and central boiler-house plant for heating and hot water installations. Extensions have been made at the company's Ecclesfield works, and special plant has been installed in order to reduce costs and help to meet keen competition both at home and abroad. Successful efforts have been made to obtain work further afield, and contracts have been obtained in Germany, Holland, Spain and Australia for steelworks plant, special grinding machinery, and brick and tile making machinery.

Position of Lighter Trades.

There has been little change in the general conditions of the cutlery and plate trades of Sheffield recently. Trade as a whole is by no means good, but some firms have satisfactory order books. It is satisfactory to note that exports of locally-manufactured safety razors to the United States maintain previous high levels, and this is one of the most encouraging branches of trade. The manufacture of razors of the old, ordinary type, has suffered badly. An interesting suggestion has been made, however, that manufacturers of the old-fashioned razor should specialise in the production of a high-quality straight razor to be used by barbers who, of course, do not adopt the safety type of razor. In connection with the affairs of the well-known and long-established firm of Martin Hall and Co., Ltd., silversmiths, electro-platers and cutlers, of Shrewsbury Works, Sheffield, Mr. Charles Turner, chartered accountant, of Norfolk-street, Sheffield, has been appointed receiver. The company, which was registered in 1866, has a capital of £85,000. Its works are carrying on as usual, and it is expected that a scheme of reconstruction and reorganisation will be embarked upon by the receiver and directors jointly.

Derwent Valley Water.

The second instalment of the Derwent Valley Water Board's works is to be opened on September 19th. The Board supplies Sheffield, Leicester, Nottingham and Derby. The first instalment of its works was opened in 1912, the yield being 13,434,000 gallons per day for the corporations and local authorities, and 6,717,000 gallons per day for compensation water. The increase in the towns' supply due to the second instalment will be 6,630,000 gallons per day, and the total quantity of water made available by the combined first and second instalments will be 20,064,000 gallons per day town supply, and 12,057,000 gallons per day compensation water. When the Board's scheme of works is complete the estimated daily quantity of water which will be obtainable will be 44,870,000 gallons, of which 29,910,000 gallons will be available for the towns and local authorities.

New Master Cutler.

Mr. Arthur Kingsford Wilson is to be installed as Master Cutler of the ancient Cutlers' Company of Hallamshire for next year. He is governing director of Spear and Jackson, Ltd., of Sheffield and Vancouver, director of the Parkgate Iron and Steel Works, and director of Joseph Rodgers and Sons, cutlery manufacturers, Sheffield.

NORTH OF ENGLAND.

(From our own Correspondent.)

Iron and Steel Trade Outlook.

WITH the passing of the holiday season iron and steel producers in the North of England are looking forward to a healthy autumn trade, and preparations are being made to carry still further the expansion in the output which has continued on a gradually increasing scale since the beginning of the year. A blast-furnace has been put out at the Consett Ironworks, but a bigger furnace is to be put into operation almost immediately, and it is probable that the Seaton Carew Ironworks, idle for years, will be working within the space of a month or six weeks. At the moment there are forty-five blast-furnaces in operation on the North-East Coast. Cleveland pig iron producers, it is encouraging to note, have been able to extend their export trade during August, but a bigger volume of business could have been done if the iron had been available.

The pig iron shipments from the Cleveland district in August totalled 23,988 tons, as compared with 19,366 tons in July. A larger tonnage of pig iron was shipped to Scotland than in any previous month this year, a fact which indicates that Cleveland is regaining its hold on a market which had been partially captured by Midland competitors. Foreign shipments have also improved to the extent of about 1000 tons, increased exports to Norway and Italy and a resumption of trade with the United States being sufficient more than to offset a drop in the shipments to Belgium. Manufactured iron and steel exports for August totalled 60,532 tons, compared with 69,791 tons in July, nearly a third of the first-named tonnage having gone to African ports.

Cleveland Iron Trade.

Autumn business in the Cleveland pig iron trade is developing on encouraging lines. There is more inquiry, both from home and foreign buyers, and some fairly large sales have been arranged this week. These are all for forward delivery, as makers are so heavily sold for the current month that they are not in a position to accept any more September orders, except for very small parcels. On the whole, no anxiety is entertained about the disposal of the make, but the rapid rise in the cost of production is a source of grave disquiet. The price of blast-furnace coke has advanced a shilling per ton. Ore prices, too, are high, and ironmasters are faced with heavy additions to their outgoings when new contracts for raw materials are negotiated. Hence a further rise in the selling prices of Cleveland pig iron is a possibility not altogether remote, and consumers recognising this are now coming forward more freely. No. 1 Cleveland foundry iron is 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d.; and No. 4 forge, 71s.

Hematite Pig Iron.

The position in the East Coast hematite pig iron trade is firmer and further upward movement in values is confidently looked for, but progress in that direction is disappointingly slow. Terms obtainable are very low compared to prices of Cleveland pig iron, and producers declare that a rise of 4s. is essential to place the hematite branch on an economic level. As quotations are a matter of individual bargaining, they vary a good deal. Customers claim they can still shade 76s. for ordinary qualities, but makers are not at all disposed to accept prices below that figure, and indeed are asking up to 76s. 6d. The attitude of merchants is stiffer, but they are unloading their holdings at a little less than the figures named by producers. No. 1 hematite is at a premium of 6d. per ton.

Ironmaking Materials.

There is little or new business passing in the foreign ore trade. Consumers are heavily bought, and are not prepared to pay rates demanded, and merchants have next to no ore to offer, except for delivery well ahead. Recent large imports against running contracts have placed users in a comfortable position as regards supplies, but apprehension is felt that deliveries may again be curtailed by shortage of tonnage. Nominally, quotations keep on the basis of best Rubio ore at 24s. 9d. c.i.f. Tees. Durham blast-furnace coke keeps scarce, and increasing output may not be adequate to growing needs. Good medium qualities are now quite 22s. 6d. delivered to North-East Coast works, and some sellers are asking 23s.

Manufactured Iron and Steel.

Active conditions still prevail in the manufactured iron and steel trade, and big outputs are maintained. Semi-finished steel producers have to contend with increasing continental competition, but they are not at all inclined to grant price concessions. Some improvement in demand for finished steel is noticeable, and, in addition to expected further substantial home buying, considerable early improvement in foreign demand is hoped for. Business with customers abroad has been light for some time, and it is believed that stocks of overseas firms have become depleted.

Tees Bridge Scheme.

The Ministry of Transport has approved of the scheme to erect a new bridge over the river Tees at Newport to provide a further link between North Yorkshire and South Durham, and has consented to pay 75 per cent. of the estimated cost, which amounts to £600,000. The Middlesbrough Corporation and Durham County Council have been pressing the case for the bridge, and whilst there may be some delicate negotiations regarding the apportionment of the 25 per cent. of the cost to be borne by the local authorities, it is hoped that the actual work of construction will be begun next year.

The Coal Trade.

The tonnage difficulty continues to have its effect on the prompt position in the Northern coal trade, and individual positions vary considerably. Some fitters are hard pressed to keep the pits at full work, especially in the Durham section. Others are well supplied with boats, and are able to hold firmly for full prices, both for prompt and forward delivery. Those that are pressing on the market offer some substantial discounts, so as to get the wagons emptied, and returned quickly to the pits. The main cause of the prompt irregularity is, as stated, the general lack of tonnage, but an influence, though in a lesser degree, is the fact that many orders from the near continental ports are being held up owing to the low water in the rivers and canals causing delays in getting stocks sent inland from the ports. Forward the outlook remains quite bright, and fitters take the view that the present heavy demands will be continued for some months ahead. Firm, but unchanged prices rule for Northumberland steam coal, best kinds being particularly strong at 15s. 9d. to 16s., with Tyne primes at 15s. and seconds at 14s. 6d. to 14s. 9d. These figures are quoted to the end of the year. There is a good market for small steams, which are in small offer at 10s. to 10s. 6d. for best or special qualities, and 9s. to 9s. 6d. for seconds. Durham steam coal is steadily priced for best large sorts at 18s., and smalls at 12s. 6d. to 13s. Durham special gas qualities are well held at 17s. to 17s. 6d., and seconds are nominally firm at 15s. 6d. to 16s. Durham coking unscreened are easy for spot clearance, but firm for mid-September and more forward positions at 16s. to 16s. 9d. The bunker coal trade is, on the whole, quite steady. Good ordinary are offered freely at 15s. 6d., but superiors are scarce at 16s. 6d. to 17s. 3d. While coke prices show no change, the undertone is showing a hardening tendency. The demand is in excess of production, and both the home and export trades exhibit increasing requirements. Gas coke is 21s. 6d. to 22s.; patent oven cokes, 24s.; beehive and special cokes, 28s. to 32s. 6d.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

NOTWITHSTANDING a fairly steady output from Clyde yards, which is well up to the pre-war average, the outlook is still most uncertain. Work in the yards is well forward, and ships are quickly brought to the launching stage, but unfortunately the flow of new contracts is not quite so steady. Furthermore, the prices obtained for new vessels are low. Consequently, the comparatively good output cannot be held to represent returning prosperity. The output for August last from Clyde yards amounted to eighteen vessels of 48,814 tons aggregate, and the total output for this year to date is 150 vessels of 372,753 tons aggregate. Of the vessels launched during August last, five were of 5000 tons or over, the largest being the "Athelsultan," twin-screw motor tanker, 9000 tons, built for the United Molasses Company, Ltd., London. Contracts placed during August included the following:—Two oil-electric oil tankers of 8000 tons each; a destroyer flotilla leader, for the Government of Jugoslavia; and a number of smaller craft.

Steel.

Business on the whole has been comparatively quiet during the past week. Makers as a rule, however, report steady employment and a brightening of the outlook, in view of the greater interest shown by overseas buyers, particularly in the Far East. Shipyard demands are fair at the moment, but producers would still welcome an increase in business for heavy material. Tube makers report improvement, and most works have steady demands and good outputs. The production of butt-welded tubes has been increased through the starting of a new mill. It is said that the turnover in oil pipe lines is large enough materially to affect the steel works supplying the strip. Steel sheets are only moderately active, but producers anticipate a return to normal activities next month. The unsteadiness of the continental market causes considerable hesitancy amongst buyers, and very little fresh business is reported, even with sheet bars at £4 18s. per ton, f.o.b. Antwerp, and slabs correspondingly weak.

Iron.

Bar iron makers are doing a little more business than for some months past, but have still plenty of scope for improvement, and similar conditions obtain in the re-rolling department of the industry. Bar iron prices are unchanged, and re-rolled steel is still quoted round about £8 per ton home and £7 15s. per ton export. There are twenty-seven pig iron furnaces in blast in Scotland at present, and the production has somewhat increased, the aggregate for July last being about 20,000 tons more than that for July, 1928.

Coal.

The coal market continues firm. The majority of the collieries are well supplied with orders for the present, and with more tonnage available outputs are going away regularly. With collieries well sold for practically all descriptions, any odd lots fetch full market prices. Demands are fair, but sellers are not prepared to commit themselves further than October. Shipments last week were 290,300 tons, against 288,201 tons in the preceding week and 233,855 tons in the same week last year. In the home market industrial and domestic requirements show an increasing tendency. Dealers in house coal are now endeavouring to obtain an increase of from 1s. to 1s. 6d. per ton for September deliveries. The strongest features of the market at present are Fifeshire prime steams, Lanarkshire splints and ells, round fuels and treble nuts.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

MATTERS relating to the coal trade have been rather more interesting during the past week or so. The immediate position is not as satisfactory as could be desired, so far as the steam section is concerned, but in the case of anthracite there is a ready outlet, and steamers are waiting to get into berth at Swansea. The reverse has been the case at the up ports in this channel, and consequently a number of collieries have not had such an easy time in keeping their pits working without interruption. Arrivals of tonnage were disappointing over last week-end. On Saturday there were nineteen idle tipping appliances, most of them being at Cardiff, Penarth and Newport, and the position was unimproved in the early part of this week. Comparatively little chartering is taking place, and there is quite a lull in activity for prompt shipment, but there is this satisfaction that the inquiry appears to be much better for later in the year. Among the notifications received is one that the Egyptian State Railways are asking for tenders for 165,000 metric tons of locomotive coals for delivery at Alexandria, and the adjudication will take place at Cairo on December 3rd. Precise particulars of the inquiry are awaited, and it is not as yet known over what period the coals will have to be delivered. Another subject which has been the cause of considerable discussion and satisfaction is the announcement that under the Reparations Agreement Italy undertakes to purchase 3,000,000 tons of coal from this country over the next three years. It is assumed that the bulk of this business will come to South Wales, as in years gone by the Italian State Railways regularly took substantial quantities of Welsh coals. Of course, more details are awaited regarding the conditions under which Italy undertakes to purchase 1,000,000 tons per annum over the next three years, and it all depends upon the extent to which reparation deliveries in kind are reduced. Still, it is understood that the Italian authorities intend to re-establish their office at Cardiff, and it is felt in local trade circles that they would not adopt this course if it was not their intention to take very considerable quantities of coal from South Wales, and it may be that the office will be kept going, not for three years only, but permanently.

Dock Rates and Charges.

The announcement of the Minister of Transport that as from October 2nd there is to be a reduction in coal tipping and weighing charges at Great Western Railway establishments, except Swansea, from 7½d. to 6d. per ton, has occasioned some satisfaction, though coalowners are disappointed that greater concessions have not been granted to them. It is, however, a step in the right direction, and on the basis of shipments during 1928 it means a sum of round about £150,000. The reduction in the charges brings the figure back to what it was in 1918. Although the official announcement states that the reduction does no apply to Swansea, it will, as a matter of fact, apply to that port, as the Great Western Railway Company has since issued an announcement that the charges will also be reduced at Swansea in accordance with the undertaking given by the company to the Swansea Chamber of Commerce that that port should not be placed in a less favourable position than other ports in this channel. While the charges for tipping and weighing are reduced, the Minister of Transport has also announced that there is to be an increase in the tipping and weighing of coke from 7½d. to 7½d. per ton.

New Coal Combine.

It is expected that an announcement will shortly be forthcoming regarding a new coal combine, it being understood that negotiations are nearing completion in connection with the formation of a new company to take over the colliery and coal-distributing interests of Guest, Keen and Nettlefolds, Ltd., and Gueret, Llewellyn and Merrett in this district. It is stated that at a meeting last week of shareholders of one of the undertakings which will be in the new combine, some details were disclosed of the basis on which the consolidation of interests will be effected, this being capitalisation at the rate of about 12s. 6d. per ton of output, which means that the total capital of the combine will be between six and six and a-half million pounds.

Coal Trade Audit.

There will be no change in the wage rate in the coalfield in this district during the current quarter. According to the audit for the three months ended July, the economic percentage certified under the terms of the agreement is 3·30 per cent. on the 1915 standard wages. This compares with a certified percentage in the three months ended April last of 10·41 per cent., but the owners are under obligation to pay the minimum of 28 per cent. on the 1915 basis rates, and this is the rate which will be payable over the current quarter. The trading results over the three months ended July showed a loss of £191,110, compared with a credit balance in the previous three months of £99,063. The cause of the less satisfactory trading results was an increase in the costs of production, which amounted to nearly 6d. per ton. Of this increase, no less than 2½d. per ton represents the amount paid to the workmen in respect of arrears of subsistence wages under the recent judgment of the House of Lords, the remaining 3½d. being made up of 2½d. in normal wages cost and 1d. per ton in costs of production other than wages. The increase in the number of persons employed compared with the number in the corresponding period of last year was about 7000, and in the number of manshifts worked, about 770,000.

Tin-plate Troubles.

Reference was made last week to trouble experienced at the Gorseinon Tin-plate Works through the men in the mill department ceasing work. Since then the men have decided to restart work, and consequently preparations are being made for a resumption to be made next Monday.

Tin-plate and Steel Bar Prices.

The tin-plate market is firmer, makers quoting 18s. 6d. to 18s. 9d. per basis box and in some cases even 19s. The price of Siemens steel bars has also been advanced from £6 6s. 3d. to £6 10s. per ton delivered South Wales and Monmouthshire.

Current Business.

There is very little change in steam coal prices as they affect large qualities, as most descriptions are on the minimum, but smalls and sized coals continue to be very firm all round, and patent fuel manufacturers are very fully engaged for prompt loading. Coke finds a ready outlet. Pitwood is still very limited in quantity for prompt delivery, but is not quite as strong as last week. It is understood that recently conferences have taken place among anthracite coalowners on the subject of these coals coming within the scope of the marketing scheme, and a provisional schedule of proposed minimum prices for the various grades has been drawn up and sent to individual collieries for their consideration.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/6 to 22/–
(1) Spanish	24/–
(1) N. African	24/–
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	24/9

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 0 0	—
No. 1 Foundry	3 18 6	—
No. 3 Foundry	3 16 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 16 0	3 16 0
No. 1	3 16 6	3 16 6
Cleveland—		
No. 1	3 15 0	3 15 0
Silicious Iron	3 15 0	3 15 0
No. 3 G.M.B.	3 12 6	3 12 6
No. 4 Foundry	3 11 6	3 11 6
No. 4 Forge	3 11 0	3 11 0
Mottled	3 10 6	3 10 6
White	3 10 6	3 10 6
MIDLANDS—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 11 0	—
,, ,, Foundry	3 13 6	—
(3) Northampton—		
Foundry No. 3	3 12 6	—
Forge	3 8 6	—
(1) Derbyshire—		
No. 3 Foundry	3 16 0	—
Forge	3 12 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 12 6	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 5 6 (*a*) / 4 7 6 (*b*) / 4 11 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 15 0	—
Second Quality Bars	9 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	—
Gas Tube Strip	11 2 6	—

STEEL (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
,, ,, (Land)	10 0 0	10 0 0
Ship Plates, $\frac{3}{8}$in. and up	8 12 6	7 12 6
Sections	8 2 6	7 2 6
Steel Sheets, $\frac{1}{2}$in.	8 15 0	8 7 6
Sheets (Gal. Cor. 24 B.G.)	13 17 6	13 10 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 12 6	—
Angles	8 2 6	—
Boiler Plates (Marine)	10 10 0	—
,, ,, (Land)	10 0 0	—
Joists	8 2 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 2 6	—
,, (Small Round)	8 5 0 to 8 7 6	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
,, (Lancs. Boiler)	9 17 6	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	7 0 0	—
Hoops	9 10 0 to 9 15 0	—
Soft Wire Rods	8 10 0	—
MIDLANDS—		
Small Rolled Bars	8 0 0 to 8 15 0	—
Billets and Sheet Bars	6 10 0 to 6 15 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 7 6 to 13 10 0	—
Angles	8 2 6	—
Joists	8 2 6	—
Tees	9 2 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/6 to 18/9
Block Tin (cash)	204 10 0
,, ,, (three months)	208 10 0
Copper (cash)	75 11 3
,, (three months)	76 7 6
Spanish lead (cash)	23 11 3
,, ,, (three months)	23 12 6
Spelter (cash)	24 5 0
,, (three months)	24 17 6
MANCHESTER—	
Copper, Best Selected Ingots	80 5 0
,, Electrolytic	85 7 6
,, Strong Sheets	110 0 0
,, Tubes (Basis Price), lb.	0 1 3
Brass Tubes (Basis Price), lb.	0 1 1
,, Condenser, lb.	0 1 3
Lead, English	25 2 6
,, Foreign	23 15 0
Spelter	25 2 6
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/6½ per lb.	
Ferro Tungsten	3/3½d. per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£24 0 0	7/6
,, ,, 6 p.c. to 8 p.c.	£23 0 0	7/–
,, ,, 8 p.c. to 10 p.c.	£23 0 0	6/6
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£34 0 0	12/–
,, ,, ,, 1 p.c. carbon	£38 0 0	15/–
,, ,, ,, 0·70 p.c. carbon	£42 0 0	17/–
,, ,, ,, carbon free	1/2 per lb.	
Metallic Chromium	2/6 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home	
	£13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/– per unit	
,, ,, 75 p.c.	£19 10 0 scale 6/– per unit	
,, Vanadium	13/– per lb.	
,, Molybdenum	4/– per lb.	
,, Titanium (carbon free)	1/– per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/4 per lb.	

FUELS.

SCOTLAND.
(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	14/–
,, ,, Ell	15/3
,, ,, Splint	16/6 to 18/–
,, ,, Trebles	16/–
,, ,, Doubles	15/–
,, ,, Singles	13/– to 13/6
AYRSHIRE	
(f.o.b. Ports)—Steam	13/6
,, ,, Jewel	16/6
,, ,, Trebles	15/6
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	12/– to 15/6
Screened Navigation	17/– to 18/6
Trebles	16/6 to 17/6
Doubles	15/–
Singles	13/–
LOTHIANS—	
(f.o.b. Leith)—Best Steam	14/–
Secondary Steam	13/6
Trebles	16/3
Doubles	15/–
Singles	12/9

ENGLAND.

(8) N.W. COAST—	
Steams	21/6 to 22/–
Household	38/– to 51/–
Coke	26/6 to 27/6
NORTHUMBERLAND—	
Best Steams	15/9
Second Steams	14/6
Steam Smalls	9/6 to 10/6
Unscreened	13/– to 13/6
Household	21/– to 26/–
DURHAM—	
Best Gas	16/9 to 17/–
Second	15/6 to 16/–
Household	21/– to 27/–
Foundry Coke	25/– to 30/–
SHEFFIELD	Inland.
Best Hand-picked Branch	26/– to 27/6 —
Derbyshire Best Bright House	20/– to 22/– —
Best House Coal	19/6 to 20/6 —
Screened House Coal	17/6 to 18/6 —
,, ,, Nuts	15/6 to 16/6 —
Yorkshire Hards	14/6 to 15/6 —
Derbyshire Hards	14/6 to 15/6 —
Rough Slacks	9/– to 10/– —
Nutty Slacks	7/– to 8/– —
Smalls	3/– to 5/– —
Blast-furnace Coke (Inland)	14/6 at ovens —
Furnace and Foundry Coke (Export), f.o.b.	22/– to 23/–

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	19/9 to 20/3
Second Smokeless Large	19/6 to 19/9
Best Dry Large	18/9 to 19/–
Ordinary Dry Large	17/9 to 18/3
Best Black Vein Large	18/– to 18/3
Western Valley Large	17/9 to 18/–
Best Eastern Valley Large	17/9 to 18/–
Ordinary Eastern Valley Large	17/3 to 17/9
Best Steam Smalls	13/9 to 14/6
Ordinary Smalls	12/6 to 13/–
Washed Nuts	22/6 to 28/–
No. 3 Rhondda Large	20/– to 21/–
,, ,, Smalls	15/6 to 16/–
No. 2 ,, Large	17/– to 17/6
,, ,, Through	15/6 to 16/6
,, ,, Smalls	13/6 to 14/–
Foundry Coke (Export)	26/6 to 36/6
Furnace Coke (Export)	21/– to 23/–
Patent Fuel	21/6
Pitwood (ex ship)	38/– to 39/–
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	33/– to 36/6
Seconds	27/6 to 30/–
Red Vein	23/– to 27/–
Machine-made Cobbles	40/– to 44/–
Nuts	40/– to 44/–
Beans	23/6 to 25/6
Peas	19/– to 19/6
Breaker Duff	9/6 to 9/9
Rubbly Culm	11/3 to 11/9
Steam Coals :	
Large	18/– to 19/–
Seconds	17/– to 18/–
Smalls	11/3 to 13/–
Cargo Through	15/6 to 16/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum) 12

Ordinary Ship, Bridge and Tank Plates and Sections 10/– if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

Engineering Trades.

THE activity of the engineering trades has been in no way diminished by the holiday season, and there is every prospect of its continuing in view of the large amount of constructional work being undertaken at home, both public and private, while the Colonies are likely to require increasing quantities of material. All the colonies have important budgets for public works, and it is stated that large orders will be placed on the market for Morocco where the ports are being extended and equipped, and as there are no preferential duties in that Protectorate, foreign firms have the same facilities as the French for supplying what is required. Locomotive and wagon builders, who have passed through some very lean years, are securing good orders, the railway companies having begun to distribute contracts, that have remained in abeyance for a long while past, and it is expected that, from the point of view of the volume of business done, the present year will prove quite satisfactory.

Structural Steel.

It is stated that the efforts being made by the Office Technique pour l'Utilisation de l'Acier to encourage the further use of steel are meeting with success, and that in many directions the material is competing successfully with reinforced concrete. The Ministry of Labour has purchased a number of steel houses which are to be erected in different parts of the country in order to demonstrate their suitability under various climatic conditions. In the laying out of aviation grounds metallic sheds are to be constructed on account of the facility with which they can be dismantled and removed, if necessary. Some large sheds of this kind have been ordered by the new Compagnie de Navigation Aerienne Marseille-Méditerranée-Beyrouth. It is remarked also that steel is being used more extensively in building construction in Paris and elsewhere. Whether justified or not, there is certainly an attempt in some quarters to foster a reaction against reinforced concrete on the ground that cement makers are endeavouring to form a "trust," which may have serious consequences in the future, in the sense that concrete construction will be controlled by a monopoly. The increasing cost of reinforced concrete construction is a factor that may, in some cases, favour the use of structural steel.

Railway Electrification.

The electrification scheme of the Paris-Orleans Railway will be completed by the work now being undertaken for connecting up the Gennevilliers supply with that of Eguzon. The scheme provides for a 150,000-volt line between the power station at Gennevilliers, near Paris, and the Eguzon hydro-electrical power station, with an extension to the Upper Dordogne, where a third hydro-electric plant will shortly be put into service. At present Eguzon is alone supplying current to the station at Chaigny, near Orleans, where the pressure is reduced to 60,000 volts, and for traction this is transformed at sub-stations about every thirteen miles to direct current at 1500 volts. The high-tension line is now being continued from Chaigny to Chevilly in order to connect up the Gennevilliers power station, the idea being not only to relieve the Paris-Orleans Railway of a dependence upon Eguzon, but also to supply current to Paris from the hydro-electric power plants. The town of Orleans is already electrified, and, when the work is completed, all the other towns in the department of the Loiret will be provided with current. On the Paris, Lyons and Mediterranean Railway it is only intended to electrify about one quarter of the system, and work on the first section between Culoz and Modane is already well advanced. Nothing has yet been definitely settled as to the continuation of the programme, but it is probable that the next section to be electrified will be Marseilles-Vintimiglia, as well as the line between Cannes and Grasse.

Works in Indo-China.

The Government of Indo-China has embarked upon a programme of public works at a cost of 3200 million francs to be spread over a period of eight years. There will be included the construction of three main lines of railway having a total length of more than 600 miles, which will connect up the navigable rivers with the ports, which also will be extended, and the equipment improved. Of equal importance is the draining and irrigation of immense areas of land which are at present unsuitable for cultivation. Already three million acres have been retrieved in this way, and under the programme another 2½ million acres will be drained or irrigated by the construction of canals. It is by no means certain, however, that the scheme will be carried out in its entirety, for it depends partly upon German reparations and more especially upon the native currency, which will have to be brought to the gold standard before anything definite can be done.

Aviation.

Since the creation of the Air Ministry there has been a steady organisation of the commercial air system, which had, until then, been allowed to lag behind the corresponding services in some other countries, and it appears that definite results have been obtained, more particularly with the service to the Far East and the securing of concessions for the carriage of passengers and mails to and from South America. While arrangements have been come to with Great Britain for co-operation in organising the service to Indo-China, a French mission has been at work in South America preparing the way for a series of lines that will connect up with the service from Natal, in Brazil, to Dakar and Toulouse. In Venezuela a concession has already been secured for the creation of an air service, and negotiations are in progress with Chile, while Bolivia and Peru have also accorded permission to the French authorities to inaugurate lines within a definite period. There is thus every prospect of the South American States being served by the French air line from Toulouse to Dakar and Natal in Brazil.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

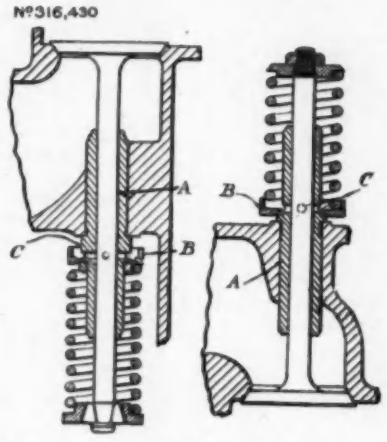
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

316,430. July 23rd, 1928.—LUBRICATION OF FLUID PRESSURE ENGINES, Robert Walsh, of 23, Audley Range, Blackburn.

This invention relates to the lubrication of the poppet valve stems of internal combustion engines, and as illustrated the construction is shown as applied to side and overhead valves. On the valve stem guide A, which is pressed into the cylinder casting, there is provided a collar B with an annular groove C forming an oil well, from which holes are taken through the guide

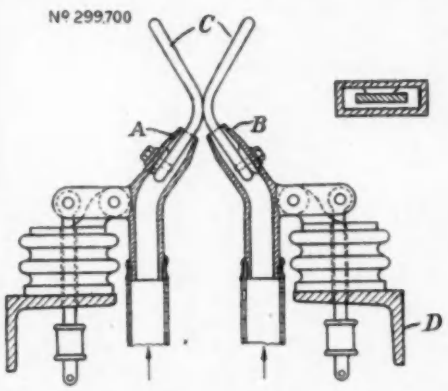


to the stem of the valve. It will be seen that the lubricant collects in the annular groove and passes into the bore of the guide at about its centre. Oil may be supplied to the well formed by the collar, either by the accumulation of oil vapour or by direct feed. It is claimed that the central lubricator of the valve stem prevents the undue passage of lubricating oil between the valve stems and their guides, which normally causes the valves to stick, with resulting scoring and wear.—*August 1st*, 1929.

SWITCHGEAR.

299,700. October 5th, 1928.—ELECTRIC SWITCHGEAR WITH AIR BLAST, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

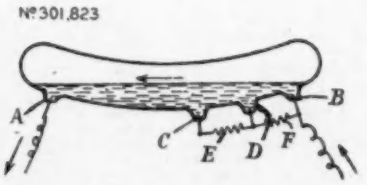
This specification describes a switch provided with an air blast by two nozzles A and B. The contacts which are attached



to these nozzles are shown at C. The two nozzles are attached to a casing D on which they can turn. The air passage is so arranged that the outflowing air stream almost surrounds the contacts on every side so that the arc cannot weaken the air current.—*August 1st*, 1929.

301,823. October 31st, 1928.—MERCURY SWITCHES, Aktiengesellschaft der Maschinenfabriken Escher Wyss et Cie., of 19, Hardturmstrasse, Zürich, Switzerland.

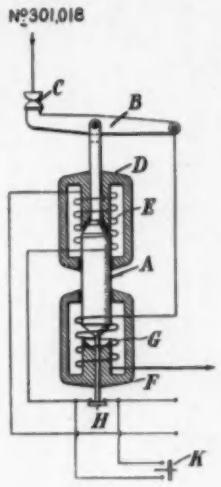
The mercury switch described in this specification has two intermediate contacts in addition to the main contacts A and B.



The intermediate contacts C and D are connected together and to one of the main contacts through resistances E and F, so that the resistance of the circuit is increased in stages when the bulb containing the mercury is tilted.—*August 1st*, 1929.

301,018. October 22nd, 1928.—HIGH-SPEED DIRECT-CURRENT CIRCUIT BREAKER, Maschinenfabrik Oerlikon, of Oerlikon, near Zürich, Switzerland.

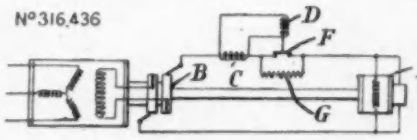
This invention relates to a high-speed direct-current circuit breaker of the type in which a circuit breaker member is held closed by a hold-on magnet, counter to the action of a release magnet excited by the main current. In the drawing, A indicates a magnet core connected to a switch lever B carrying a contact C. The lever is adapted, on the one hand, to be attracted and held by a separately energised hold-on magnet D with a coil E, and, on the other hand, to be influenced by the main current magnet F with the coil G. The magnet coils E and G are so dimensioned that in consequence of the greater attractive force of the magnet F in the case of excess current, the magnet core A is drawn into



the coil G, whereby the lever B opens the contacts C. The lever B is positively interconnected with a contact member H in the energising circuit of the hold-on magnet E so that the energising current for the hold-on magnet E is interrupted on the slightest downward movement of the core A. The switching-in of the contact C is effected by closing a switch K arranged to bridge the contact H. The arrangement may, however, also be such that the circuit breaker recloses automatically.—*August 1st*, 1929.

316,436. July 25th, 1928.—PROTECTION OF ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES AND SYSTEMS, Electrical Improvements, Ltd., of Carliol House, Newcastle-upon-Tyne; and Lewis Colin Grant, of Wandsworth House, Heaton, Newcastle-upon-Tyne.

In accordance with this invention, between the exciter A of an alternator and its slip rings a current transformer C is con-

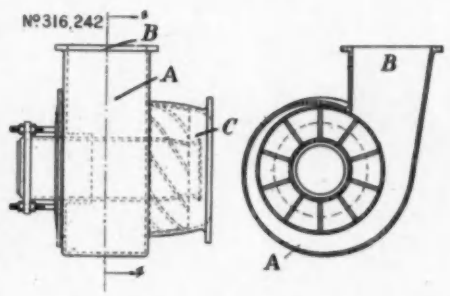


nected, and the secondary winding of this transformer is connected to the operating coil of a quick-acting switch F, which, in the event of a sudden overload, inserts a resistance G in the exciter circuit. If the fault is of very short duration the breaker F closes again almost immediately. Thus a transient short circuit or heavy fault may clear itself without producing undue stresses in the alternator or without causing an interruption of the supply.—*August 1st*, 1929.

FURNACES.

316,242. April 26th, 1928.—IMPROVED PULVERULENT FUEL BURNERS, The General Electric Company, Ltd., of Magnet House, Kingsway, London, W.C. 2; and George Siddon Woollatt, of "Penthorpe," Bexley-road, Erith, Kent.

This invention relates to burners for pulverised fuel. The mixture of air and powdered fuel enters the volute chamber A through the single inlet B and flows forward to the annular outlet C at which ignition and combustion takes place. The longitudinal delivery of the fuel and air mixture to the volute chamber sets up, it is claimed, a whirling motion which assists in maintaining the uniformity of the mixture so that rapid combustion takes place at the burner outlet and the desired short



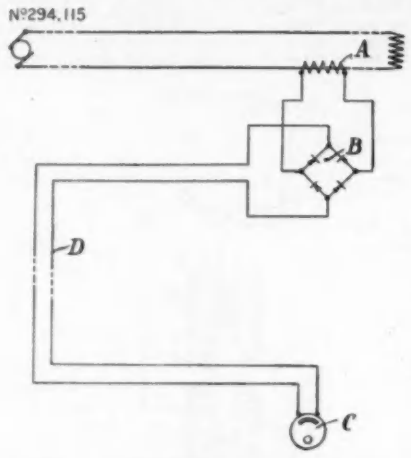
flame is produced. The inventors claim a simplification in that the mixture is delivered to the burner in a single branch and the more usual arrangement of both priming and secondary air is done away with. In the drawing reproduced the burner tube is adjustable in length and it is closed at the end by a cover plate with an opening for introducing the lighting-up torch. Other arrangements are also illustrated, in which means are provided in the annular passage to increase the turbulence of flow of the mixture. One such method consists in introducing a toroidal member arranged coaxially with the annular passage, dividing it into inner and outer annuli. Such a toroidal member may be cast integral with the guide vanes.—*July 26th*, 1929.

MEASURING AND TESTING INSTRUMENTS.

294,115. July 16th, 1928.—REMOTE ELECTRIC METERING SYSTEMS, *Associated Electrical Industries, Ltd., of Bush House, Aldwych, Westminster.*

The apparatus for measuring alternating current in accordance with this invention comprises a current transformer A which is

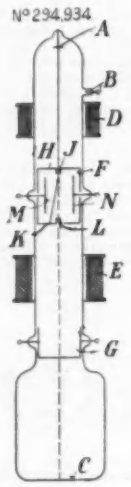
connected to a full wave rectifier B in the manner shown and which supplies the direct-current meter C. Any increase or decrease of the resistance of the conducting line D does not affect



the accuracy of the instrument, because of the compensating action of the transformer.—*July 25th*, 1929.

294,934. July 20th, 1928.—CATHODE RAY OSCILLOGRAPHS FOR TAKING PHOTOGRAPHS OF NON-REPEATING PHENOMENA, Dr. Walter Rogowski, of No. 2, Wüllnerstrasse, Aachen, Germany; and Dr. Eugen Flegler, of the same address.

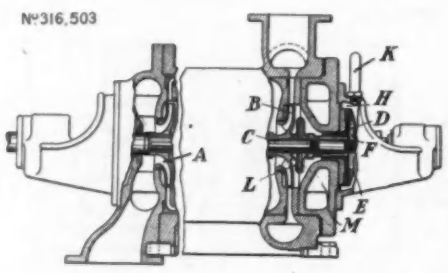
The cathode ray oscillograph described in this specification is for taking time and instantaneous photographs of non-repeating phenomena. A is the cathode and B is the anode. At C there is a photographic plate or film which may also be replaced by a fluorescent screen. D and E are two concentrating coils. Interposed between the cathode A and the photographic layer C is a cathode ray blocking chamber F. G is a Faraday's cage for measuring the electron stream. The blocking chamber has a diaphragm H with a hole J, and at its other end a diaphragm K with a hole L. The chamber F also contains two oppositely disposed deflecting plates M N. The rays emitted by the cathode A, after being concentrated by the coil D, pass through the hole H into the blocking chamber F. In the chamber F the electric fields existing between the deflecting plates M N deflect the ray in such a manner that it is wholly confined in the chamber and neither electrons nor emanated Röntgen rays can pass out of the chamber. By causing the electric fields between the plates M and N to disappear the blocking of the cathode ray is released, so that the electrons will then pass through the opening L and can be used for tracing oscillograms on the plate C.—*July 25th*, 1929.



PUMPING AND BLOWING MACHINERY.

316,503. December 20th, 1928.—CENTRIFUGAL MACHINES, Sulzer Frères Société Anonyme, of Winterthur, Switzerland.

According to this invention, means are provided to equalise or compensate the expansions of different magnitude between the shaft and the parts it carries produced by temperature changes. The water to be pumped is drawn from the suction branch by a first impeller wheel A and delivered by intermediate impeller wheels—not shown in the drawing—to the last wheel marked B into the delivery branch. The shaft C may be made, for instance, of steel and is supported in the bearings, the impeller wheels being of gun-metal or some such alloy. At the delivery side of the pump a relief device for the axial thrust is provided. The water under pressure taken from a given stage—for instance, from the last one—is conveyed through a slot D into a chamber E, from which it passes in a thin film, determined

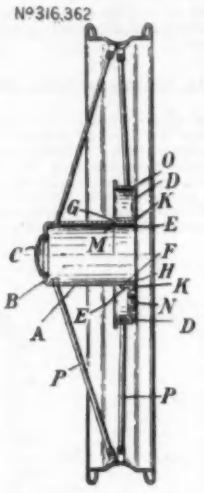


by the position of the relief disc F, into a chamber H, whence it escapes through a pipe K. Owing to the relief device, the force resulting from the axial components of the medium conveyed is equalised. On the other hand, as the individual parts connected to the shaft, for example, the sleeves which are shrunk on to the shaft and the hubs of the impeller wheels, are formed of a different material from the shaft, expansions of different magnitude consequently occur—especially at high temperatures—which are not normally equalised. To equalise these changes an intermediate compensating device is provided comprising two elastic members L and M secured to the shaft so as to rotate with it. The space formed between the two members L and M may be empty or filled with water under pressure. The provision of this compensating element is of particular importance in the case of long shafts.—*August 1st*, 1929.

MOTOR CARS AND ROAD TRAFFIC.

316,362. May 14th, 1928.—MANUFACTURE OF WIRE WHEELS FOR VEHICLES, Alfred Ernest Owen and Robert Wilford Downs, both of Victoria Works, Darlaston, Stafford.

The hub of the wire wheel described in this specification comprises a tube A, one end B of which is partially closed by spinning or pressing, and this end is machined to take a sealing cap C. The spoke flange comprises a pressed metal annular flanged dish D with an inturned flange E forming a central bore F of such diameter that it is adapted to fit tightly on the tubular hub A when this is forced under pressure through the bore F into the position shown in the lower half of the drawing. The other or open end H of the tubular hub A is swaged over the inner end K of the flange E. In the alternative preferred construction shown in the upper half of the drawing a bulge G is formed in the wall of the

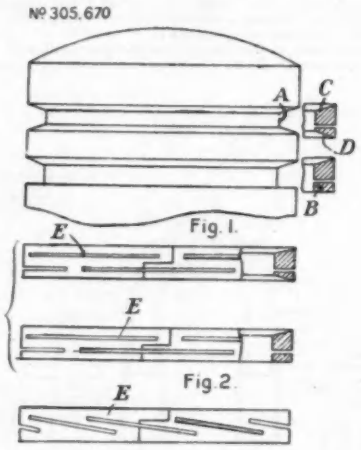


tube a suitable distance from the end H, and the flange E abuts against the shoulder M formed by the bulge so that the spoke flange is securely held between this shoulder M and the swaged over end H, which in both constructions is welded to the spoke flange at the point of swaging. Depressions N are formed in the spoke flange D to take the studs and nuts by which the wheel is secured to the brake drum or the axle flange, and holes O for the reception of the spokes P are formed around the outer periphery of the spoke flange D and the hub A.—*August 1st*, 1929.

MISCELLANEOUS.

305,670. February 8th, 1929.—IMPROVEMENTS IN RING PACKINGS FOR PISTONS, Konus-Kolbenring Werk, G.m.b.H., of A-B-C Strasse Nos. 44/45, Hamburg, Germany.

In this specification several new types of split piston rings with a conical end face converging towards the axes of the rings are described. They are illustrated in Figs. 1 to 3 herewith. Figs. 1 and 2 show sections and an elevation view of the piston and its rings. It will be seen that piston grooves A and the packing rings B are coned on their upper and lower faces C and D, these faces being both inclined to a plane perpendicular to the axis of the piston. These inclined faces are so arranged that the



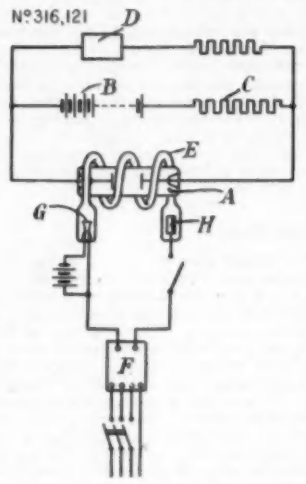
opposite faces of the ring and the groove can slide upon one another when the pressure acting upon the ring overcomes the friction. This pressure will be produced by the axial elastic force within the ring which is inserted into the groove when in a compressed state. As shown by the lower ring in Figs. 1 and 2, one end face of the ring may differ in conicity from the opposite face or may be square as drawn. In such a case the advantages claimed for the double conical construction are obtained, but not to the same extent. In the first two views, Figs. 1 and 2, the slots or flutes E extending through the ring and overlapping are shown cut at right angles to the piston axis and parallel to the upper and lower rings, whereas in Fig. 3 these slots are inclined.—*July 25th*, 1929.

305,201. December 20th, 1928.—VANADIUM ALLOYS, *Vanadium Corporation of America, Bridgeville, Allegheny County, Pennsylvania, U.S.A.*

The alloy according to this invention, consisting approximately of 85 per cent. to 95 per cent. or more vanadium, can be produced in the electric furnace by the use of a suitable reducing agent, such as silicon; although it is preferred to produce it by the reduction of a very high grade of vanadium pentoxide which contains a small amount of iron in the form of oxide by means of aluminium as reducing agent, according to the well-known process of alumino-thermic reduction. If, however, the very high grade of vanadium pentoxide used in the reduction mixture does not contain any iron, it can be introduced by mixing metallic iron or iron oxide with the high-grade vanadium pentoxide. An alloy produced by this process from a high-grade oxide has the advantage of not being contaminated with carbon and silicon to an appreciable extent, which would be the case were it produced by reduction by means of silicon in the electric furnace. If care be exercised in the preparation of the vanadium pentoxide and the reduction material, keeping it free from excessive percentages of impurities, a resulting alloy can be obtained by alumino-thermic reduction containing vanadium and iron alone with negligible percentages of deleterious impurities, and in which the silicon is less than 1·25 per cent. and the carbon less than ·50 per cent. Such an alloy, it is stated, enables the steel maker to make his additions without fear of altering the composition of his finished steel in regard to impurities, thus avoiding the possibility of obtaining reject heats of the finished steel.—*August 1st*, 1929.

316,121. April 23rd, 1928.—INFLUENCING AN ELECTRIC CURRENT BY MEANS OF RADIATION, *Stanley Gordon Sinclair Dicker, of* 20 *to* 23, *Holborn, London, E.C.* 1.

In the drawing A is an electric discharge tube filled with neon. A battery B supplies a voltage to the electrodes of the tube through the resistance C, and this voltage is measured by means of an electrostatic voltmeter D. A helically wound neon light



tube E surrounds the discharge tube A and this tube is supplied with current from a rectifier F. The luminous tube comprises an incandescent cathode G and a cold anode H. Light from the luminous tube E influences the current in the main circuit comprising the tube A and battery D, and the device is therefore capable of converting optical phenomena into electrical phenomena.—*July 23rd*, 1929.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

SATURDAY TO SATURDAY, SEPTEMBER 7TH TO 14TH.

MODEL ENGINEER EXHIBITION, Royal Horticultural Hall, Vincent-square, Westminster, London, S.W. 1.

MONDAY TO SUNDAY, SEPTEMBER 9TH TO 15TH.

INSTITUTE OF METALS.—Annual autumn meeting, Düsseldorf, Germany. Monday, September 9th, in the Aula of the Lessing Oberrealschule, Ellerstrasse, Düsseldorf, 5 p.m. Eighth autumn lecture, by Dr. A. G. C. Gwyer, B.Sc., "Aluminium and its Alloys." Tuesday, September 10th, 9.30 a.m., in the Hall of the Eisenhüttenhaus, Verein Deutscher Eisenhüttenleute, 27, Breitstr., Düsseldorf. Reading and discussion of paper (see page 66, July 19th, 1929). Wednesday, September 11th, 9.30 a.m., in the Hall of the Eisenhüttenhaus, Verein Deutscher Eisenhüttenleute, 27, Breitstr., Düsseldorf. Reading and discussion of paper (see page 66, July 19th, 1929). Thursday, September 12th, 8.15 a.m., whole-day excursion to Messrs. Krupp, Essen. Friday, September 13th, to Sunday, September 15th, visits to Berlin and Holland.

TUESDAY TO FRIDAY, SEPTEMBER 10TH TO 13TH.

IRON AND STEEL INSTITUTE.—Autumn meeting at Newcastle-on-Tyne.

WEDNESDAY, SEPTEMBER 11TH.

MANCHESTER ASSOCIATION OF ENGINEERS.—Visit to works of Leyland Motors, Ltd., Leyland. 2.30 p.m.

THURSDAY TO SATURDAY, SEPTEMBER 12TH TO 28TH.

SHIPPING, ENGINEERING AND MACHINERY EXHIBITION, Olympia.

SATURDAY TO SATURDAY, SEPTEMBER 14TH TO 28TH.

INSTITUTION OF NAVAL ARCHITECTS.—Summer meeting in Italy. For programme see page 380, April 5th, 1929.

WEDNESDAY, SEPTEMBER 18TH.

INSTITUTION OF CIVIL ENGINEERS: YORKSHIRE ASSOCIATION.—Visit to Scar House Reservoir, Nidd Valley, Bradford Corporation Waterworks. Meet at the Engineer's office on the site from 2.15 to 2.30 p.m.

FRIDAY, SEPTEMBER 20TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—North-Western District meeting at Bebington and Bromborough, Cheshire. Assemble at Hulme Hall, Port Sunlight, 11 a.m. Paper on "Development and Works in the Bebington and Bromborough District," by Mr. Percy Parr.

FRIDAY AND SATURDAY, SEPTEMBER 27TH AND 28TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Institution meeting to be held in the Isle of Ely.

FRIDAY AND SATURDAY, SEPTEMBER 20TH AND 21ST.

INSTITUTION OF WATER ENGINEERS.—Informal autumn meeting. Visits to the works of the Wakefield and Barnsley Corporations.

THURSDAY, NOVEMBER 21ST.

BRITISH WATERWORKS ASSOCIATION.—Public Works Congress at the Agricultural Hall, London. Papers: "Water Supply as a Factor in Town and Regional Planning," by Mr. G. L. Pepler, F.S.I.; "The Preservation of Rivers and Streams from the Standpoint of Water Supply: Some Observations on River Pollution," by Dr. J. B. Firth; "The Purity of Drinking Waters from a Biological Aspect," by Dr. W. Rushton.